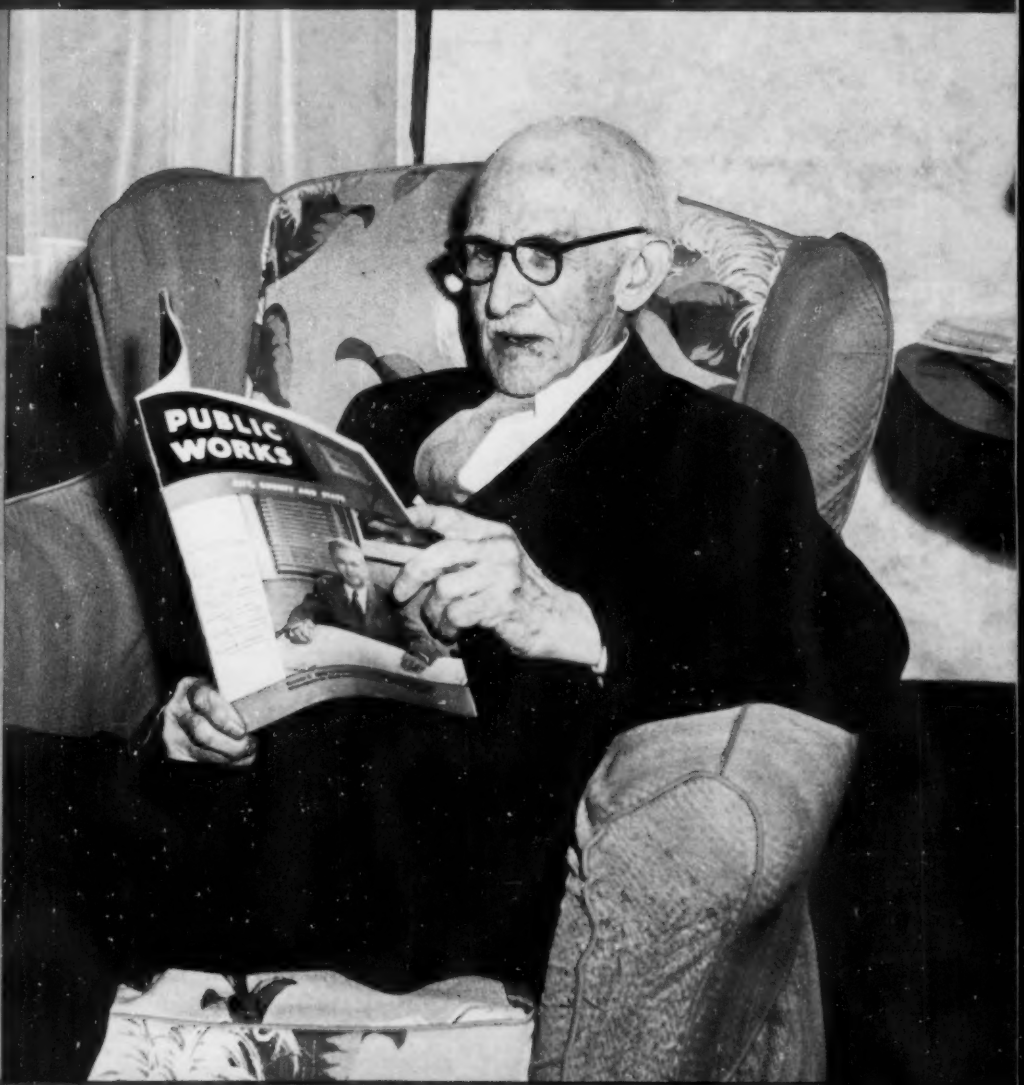
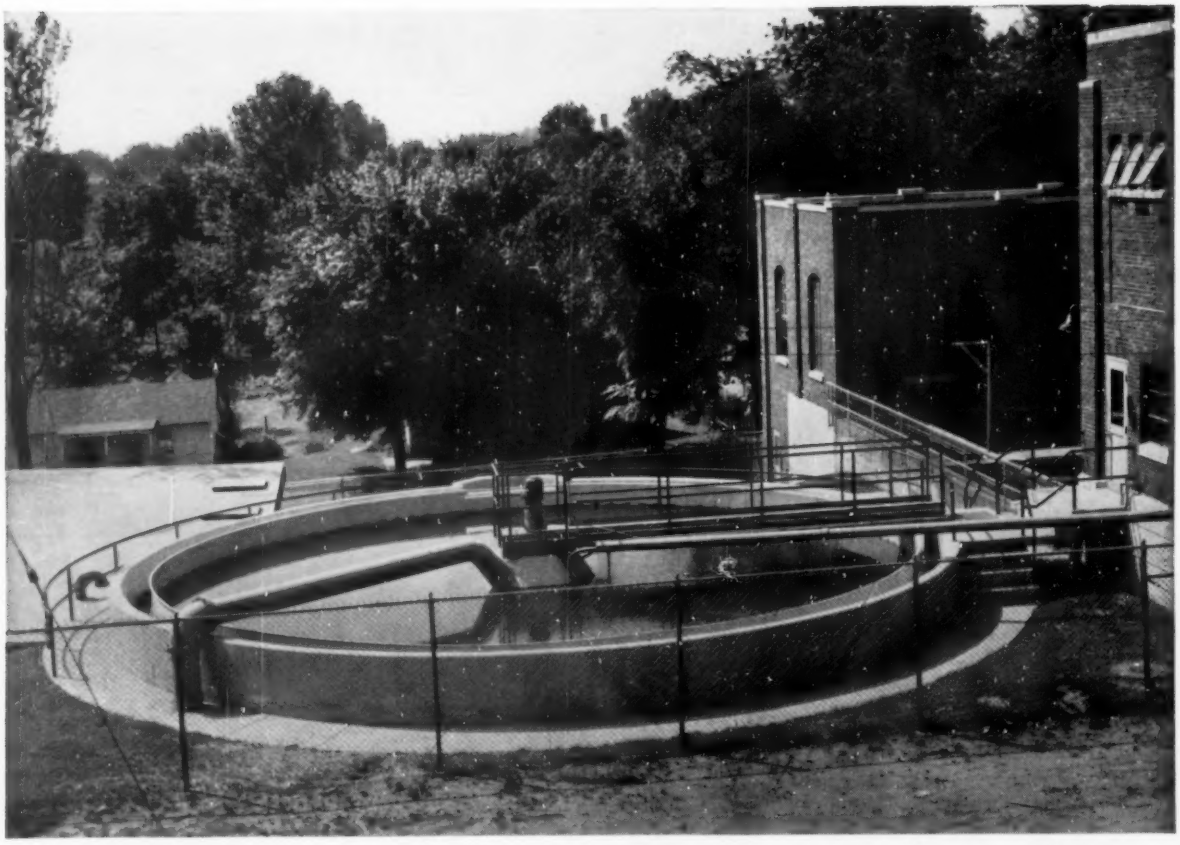
PUBLIC WORKS

Apr. 1957

CITY, COUNTY AND STATE



A. Prescott Folwell, long-time leader in public works, a dean of the engineering profession, for nearly fifty years Editor of "Public Works," retired but still active and going strong. More on page 22.



RAPID CLARIFICATION: Storms can increase Wabash River turbidity from 50 to 1500 ppm in as little as six hours! No matter how much or how fast turbidity changes, this Permutit Precipitator cuts it to less than 5 ppm in one fast step!

Clear water for Mount Carmel despite rapid turbidity jumps of 50 to 1500 ppm in 6 hours!

GROWTH OF POPULATION and increasing settling-basin odors from sewage and oil-field wastes persuaded Mount Carmel officials to look for a more efficient water-treatment plant. The new plant would have to deliver twice as much water . . . eliminate bad odors . . . handle spurts of *high* turbidity.

HOW IT'S DONE: A suspended sludge-blanket type of equipment was indicated, and a Permutit Precipitator was installed. Now they get 2½ mgpd of clear water *in half the time* it took two old settling basins to treat only 1½ mgpd! All with *no increase in manpower.* There are no more bad odors during treatment. Chemical costs are lower.

FILTER SAVINGS: Added to the existing three filters . . . two new filters with Permutit Monocrete® Underdrain Systems that are non-corrodible, low in cost, easily built.

AUTOMATIC FEATURES: Mount Carmel's Precipitator has photoelectronic control. The unit is automatically blown down in direct proportion to the flow rate and the amount of total solids precipitated. Since the three existing filters had obsolete controls, five new gravity filter operating tables were installed to control backwashing and filtering automatically!

"Everything is running smoothly. We're getting a better grade of water . . . clearer water," reports Supt. Elmo Conrady.

"It's all automatic. Mud goes right back into the river . . . eliminating the cleaning of basins," reports Chief Operator Cedric Seaton.

"It has given excellent performance since operation began," report Warren & Van Praag, Inc., Consulting Engineers, Decatur, Illinois.

PERMUTIT WILL WORK WITH YOU to modernize your present plant or to plan a new one. Call us early in planning so we can be of most help. The Permutit Company, Dept. PW-4, 330 West 42nd Street, New York 36, N. Y.

PERMUTIT®
WATER CONDITIONING
Equipment • Resins • Experience

WHY IT PAYS TO STANDARDIZE ON CATERPILLAR-BUILT EQUIPMENT

The Village of Valley Stream, N. Y., has a line-up of big yellow machines that includes two CAT* D6 Tractors, a D4 and a No. 212 Motor Grader. One of the D6s, equipped with a No. 6S Bulldozer, is shown here doing one of the many jobs that makes it such a useful tool. In this case it's clearing away scrub trees to build a 50-car village parking lot.

There are several reasons why it pays a municipality, large or small, to standardize on dependable earthmoving machines built by Caterpillar.

1. Operators become more efficient. They like the visibility, comfort and ease of control of Caterpillar equipment.
2. Maintenance is simplified as mechanics become familiar with one line of equipment. Lubrication schedules become routine. And many parts can be interchanged among various Cat-built machines.
3. A quarter century of diesel leadership has produced engines for all Caterpillar-built equipment that are as foolproof as engines can be made. They're built to operate on a wide range of low-cost fuels, including No. 2 furnace oil.
4. Resale value is uniformly high for Cat-built equipment . . . almost without exception, the highest in the field.

And finally, you get parts and prompt, efficient service for all your machines from one responsible source—the Caterpillar Dealer. Get full details on the advantages of standardization from him. He backs every single product he sells with reliable service and Caterpillar parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES

• • • SERVING THE PUBLIC WORKS INDUSTRY • • •

PUBLIC WORKS DIGESTS

DEPARTMENTS AND SECTIONS

BPA

Public Works T. M. Reg. U.S. Pat. Off.

Established 1896

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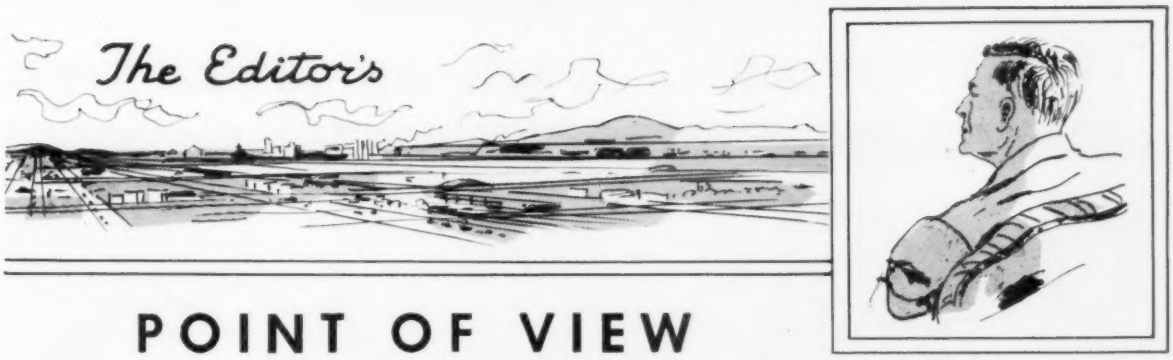
APRIL 1957

PUBLIC WORKS

Vol. 88, No. 4



POINT OF VIEW

Public Works Engineering Procedures for Winter Have Been Improved

TO THOSE OF US who live, either by necessity or choice, in cold-weather areas, engineering advances have been little short of wonderful in controlling many of the hardships incident to snow and ice. Not the least of these is the use of chemicals to assure, for much of the wintertime, bare pavements on which one can drive safely. Salt and calcium chloride, combined with the speed of radio communication, and well-designed snow plows mounted on powerful trucks, tractors and graders, have made roads passable and safe practically all of the time. Our engineers and our equipment men are due the hearty congratulations and thanks of the motoring public.

Health Department Engineering Salaries Are Low

PROBLEMS OF recruitment of qualified engineers and sanitarians by local health departments are reflected in the first of five reports by the Committee on Salaries of the Conference of Municipal Public Health Engineers. Failure of health departments to pay the going price for competent personnel in environmental health services is resulting in a growing shortage, especially of engineers.

The Committee surveyed the salaries of engineers, sanitarians, sanitary inspectors, veterinarians, and other environmental health personnel in 371 full-time local health departments. According to the report, salaries have been rising steadily at rates varying from 5 to 13 percent each year, but they fail to match those paid in similar professional categories outside of health departments.

Salaries for engineers are well below those paid to other members of the profession. In 1952-54, the median salary was $1000 below the median for county and municipal engineers and $2,400 below the median for all engineers. Under the circumstances, the number of vacant engineering positions in local health departments is increasing rapidly.

Starting salaries in local health agencies for engineers with no experience in 1956 ranged from $4,250 to $4,650. The same year engineering schools reported a median starting salary of $5,040 and predicted that their 1957 graduates will expect around $5,250. In addition to paying higher salaries, private employers often pay interview and moving expenses and provide other fringe benefits.

While top salaries for sanitarians have been rising more rapidly since 1954 than for any other salary group, the median salary since 1952 has been $2000 or more below that of engineers in local health departments and approximately $750 below the median salary paid to male professional and technical workers in the United States. Of the sanitarian positions studied 7 percent were vacant. One-third of these were available to college graduates with no experience, offering a starting salary of $4,479. Vacant positions for sanitarians offer higher salaries than filled ones. Among 675 filled positions with the same requirements, the median starting salary was $4,347.

These data emphasize the fact that public health work may be rewarding professionally but it is not sufficiently so financially.

Utilization of Engineers in the Military Services

IT IS PROBABLY a practical impossibility to accomplish even nearly maximum utilization of engineering skills in the military services, during either war or peace. Other factors than technical needs may determine immediate utilization. There is, however, one place where peace-time improvement should be made. Many engineers are graduated from colleges holding ROTC commissions in line branches. In the past it has been exceedingly difficult to persuade the line to permit transfer of these technically educated men to appropriate technical branches. The solution to this appears to be a realistic and impartial review of all ROTC personnel two or three years after graduation.

This, of course, applies only to reserve personnel. Better utilization of engineering skills in the regular services is another matter and one that needs careful study. Somehow, we do not feel that the services are doing too poorly, all things considered.

A Forward Step in Solving the Refuse Disposal Problem

A RECENT regulation by the New Jersey State Department of Health eliminates the use of the unsanitary refuse dump and requires that municipalities utilize either incineration or sanitary landfill. This is a courageous and realistic requirement, long needed. Though still subject, we believe, to legislative approval, this regulation will do a great deal toward emphasizing the need for better refuse disposal.

The more the picture changes

Our American water picture has changed drastically since the first cast iron pipe was laid over a century ago. Today, 44 public utilities in the United States and Canada still use cast iron water mains installed 100 and more years ago! *Modernized* cast iron pipe, centrifugally cast, is even tougher, stronger, more durable. Even more efficient than the cast iron pipe whose unique record for longevity has remained unchallenged through a century of technological progress.

Two of four parallel lines of 10" Mechanical Ball Joint cast iron pipe being installed across Mobile River, Ala.

CAST IRON PIPE

the more it is the same

Cast iron pipe to be installed for sewers and other services at industrial plant at Bellwood, Ill.

More than a mile of cement-lined, seal coated Mechanical Joint cast iron pipe carrying mine water for coal company at Sumiton, Ala.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Ill.

SERVES FOR CENTURIES...

CITY OF CARLSBAD

P. O. Box 265

CARLSBAD CALIFORNIA

Allis-Chalmers Manufacturing Company

Dear Sirs:

In August of last year, the City purchased an Allis-Chalmers Model D Diesel Motor Grader to replace an Allis-Chalmers AD-3 Grader which had been in use since the City's inception.

While we had no complaint as to the service of the larger machine, it had been purchased as a used grader and was larger than needed for maintenance, oil mixing, ditching, etc.

Although doubt was expressed by some experienced equipment operators as to the Model D's capabilities owing to its size, it has now made firm believers of all who have seen it mixing oil, grading, and doing all of the jobs on which it has been used. What it has lacked in size, it has made up in power, speed, economy, and ease of handling.

While this machine is too small for use on heavy construction jobs, it would fill a myriad of uses which would not be suitable for the larger machine.

I believe the grader we have is the answer to all of the uses a city could find for this type of machine.

We are all very much pleased with its performance and recommend it most highly.

C. A. ANTHONY
Director of Public Works

Model D—performance-proved *in Carlsbad, California*

A fine performance for the "D" in Carlsbad—and in hundreds of other cities, towns and counties. See your Allis-Chalmers construction machinery dealer for further information about the versatile Model D . . . the pioneer motor grader in the low-price field. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Two models available | **50-hp diesel—9,350 lb.**
50-hp gasoline—8,800 lb.

ALLIS-CHALMERS ***Engineering in Action***

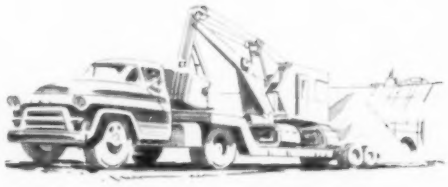
EATON 2-SPEED AXLES

Keep Trucks Out of the Shop!

Whenever you cut down on wear and tear—keep trucks on the job, out of the shop—you're adding to profits three ways: 1—By keeping trucks *earning*, not *costing*. 2—By saving the expense involved in interrupted service and delayed trips. 3—By cutting actual parts-and-labor maintenance costs.

That's exactly what Eaton 2-Speed Axles do. By furnishing the *right* gear ratio for every operating condition, they reduce stress and wear on engines and all power transmitting parts. In addition, Eaton 2-Speed Axle trucks last longer, haul more at lower cost, and are worth more on the trade-in.

It all adds up to this: when you specify Eaton 2-Speed Axles, you're swapping *expenses* for *profits!*



More than Two Million Eaton Axles in Trucks Today. For complete information, see your truck dealer.

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

PRODUCTS: Engine Valves* Tappets* Hydraulic Valve Lifters* Valve Seat Inserts* Jet Engine Parts* Hydraulic Pumps Motor Truck Axles* Permanent Mold Gray Iron Castings* Forgings* Heater-Defroster Units* Automotive Air Conditioning Fastening Devices* Cold Drawn Steel* Stampings* Gears* Leaf and Coil Springs* Dynamatic Drives, Brakes, Dynamometers

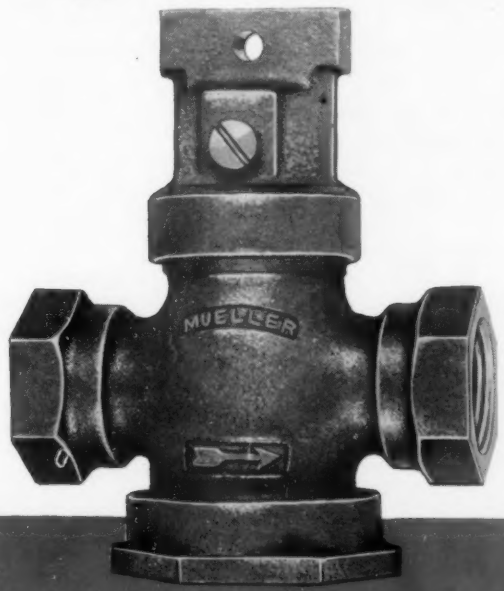
MUELLER®

IMPROVED CURB BOX

Telescopic upper section prevents damage to stop, line or box from heavy loads . . . upper section held in any position by strong phosphor bronze spring . . . allows for grade changes, settlement or frost heave . . . cannot be pulled out of base . . . bronze-bushed lid assures easy removal of access plug at all times . . . curb box completely coated with tar base enamel . . . for stops in sizes from ½″ through 2″ . . . lengths from 2′ through 10′ . . . optional foot-piece centers stop and provides solid support for curb box.

INVERTED KEY CURB STOP

Tapered key individually ground and lapped for perfect pressure-tightness . . . key seated by base cap *and* water pressure . . . increase in water pressure automatically increases key-seating force . . . key is unseated for easy turning by tapping downward on shut-off rod . . . pressure instantly reseats key . . . combined cap and tee has accurate built-in check . . . all parts cast from finest waterworks bronze . . . various combinations of inlets and outlets for any type, or types, of service pipe . . . sizes from ½″ through 2″.



See your Mueller Representative, Catalog W-96 or write direct for detailed information on Mueller's full line of curb stops, curb boxes and related waterworks products.

MUELLER CO.
DECATUR, ILL.

Since 1857

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

Robert Groff, owner of Northridge Equipment Rentals, California, takes delivery of his 18th Le Roi Compressor, model 85.

"Here's How I Make Money on Compressor Rentals"

LeRoi Compressors give top performance, require little maintenance, bring maximum profits from satisfied customers.

New units rented out minutes after delivery.

"If I have to make two service calls a month on a rental compressor, I lose the profit on that month's use," says Robert Groff, owner of Northridge Equipment Rentals, Northridge, California.

"That's why I always choose Le Roi and now own eighteen," says Groff. "They run day after day with little care, attention, or upkeep."

Dependability and performance are the cornerstones of Groff's successful business. His customers expect trouble-free equipment, economical in operation, and Groff sees that they get it! No company, he says, can hope to succeed in a rental business if they put their money into inferior equipment.

So much in demand are Le Roi Compressors that the eighteenth unit, shown above, was rented out minutes after delivery.

The Le Roi Air Compressor units rented out by Groff have a capacity of 85 cfm. They're ideal where portability is important . . . they trail well behind vehicles, and are balanced so that one man can easily position them on the job-site.

They're easy to operate, too. One control — the starter button — gives you 85 feet of air at 100 pounds pressure. That's more than ample for powering a heavy breaker. They are a perfect power source for Le Roi Newmatic Air Tools.

There's a big, lockable tool box on each unit — weathertight, and large enough to hold air tools, hose, and accessories.

Other Le Roi Compressors range in capacity from 105 to 600 cfm. All of them feature Le Roi's integral packages — proved air sources with power matched to the compressor by a manufacturer who knows both engines *and* air.

The qualities that make Le Roi air compressors money-makers in rental service are the same qualities that make them the favorite of owners, everywhere.

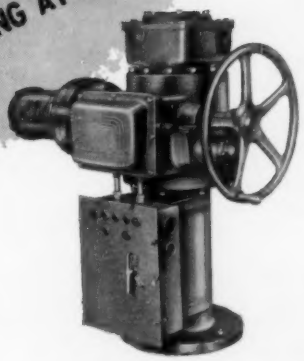
Whether you rent or buy, Le Roi's can be counted on for dependable, trouble-free operation.

PC-71

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

LUDLOW VALVE ACTUATION

LUDLOW ENGINEERING AT ITS BEST



Motor Operated Stand with Integral Control Equipment.

Power actuation is available as a complete carefully engineered unit. Actuation may be by electric motor, air motor, or air or fluid cylinder type motivation. The power unit is compact and self contained, with sturdy supports which attach to the top of any Ludlow or Rensselaer Type Valve.

Manual operation is provided for all electric and air motor operated valves. Our engineers will be glad to help you lay out a plan based on our many years of experience in power actuation systems of all kinds for all purposes.

A wide selection of floor and bench stands, geared and non-geared, all types of indicators, check valves and air release valves are available for the modern pumping station.

19

MOTOR OPERATED VALVE

FLOOR STAND

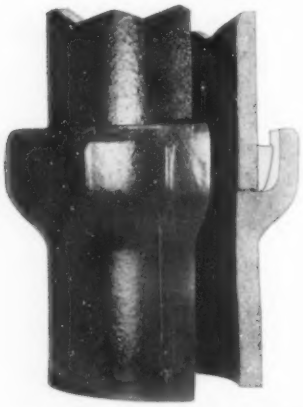
F-M INDICATOR POST

LUDLOW & Rensselaer

LUDLOW RENSSELAER VALVES & HYDRANTS

Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.

Neither Rain, Nor Sleet, Nor Mud . . . slowed the installation of this AMVIT* LINE



If you can dig the trench, you can install Amvit Jointed Clay Pipe. Bad weather and mud won't slow the laying of an Amvit line.

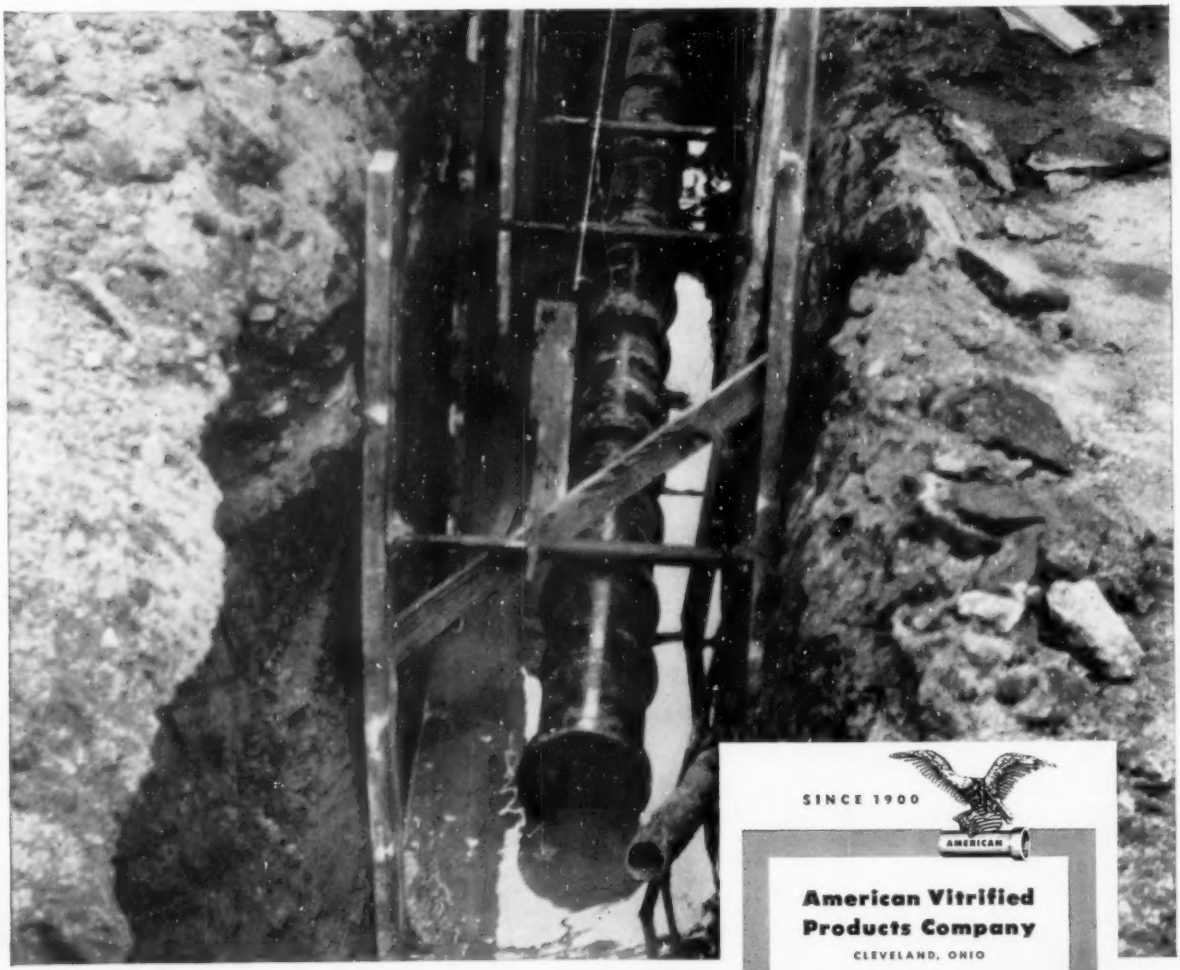
The joint is on the pipe delivered to the job ready for use. Nothing else is needed. Just push the pipe together and the joint is complete.

No other materials such as caulking, joint compound, joint runners, hot-pots, or ladles are needed to make the Amvit Joint. Savings on materials and labor mean *lower cost of pipe in place.*

Amvit is a compression type joint on the ball and socket principle. No adhesives or other compounds are needed to make a tight seal. Once the joint is complete, nothing can enter or leave the line.

Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings, is available for immediate delivery in the Northeast and Central States.

For more information and our new Amvit brochure, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.



SINCE 1900

AMERICAN

American Vitrified Products Company

CLEVELAND, OHIO

The Amvit joint is made of an acid resistant plastic material with rubber characteristics. Like the pipe, the joints will not be harmed by any condition of underground service. The pipe is simply pushed together. The trench is then ready for backfilling.

MANUFACTURERS of: Clay pipe, flue liners, clay liner plates and concrete pipe.

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • Uhrichsville, Ohio

*T.M. Registered, Patents Pending

Now! A ten-ton wheel loader with ONE-LEVER control of all speeds – forward and reverse

- 21,000 lb
- 2-cu yd capacity
- 100 hp

New TRACTOMOTIVE TL-20 TRACTOLOADER®

FASTEST-OPERATING BIG LOADER YOU'VE EVER SEEN A full power-shift transmission with ONE-LEVER control enables you to go from *any* forward to *any* reverse speed *instantly*. There's no speed range lever — *one lever controls all speeds*, forward and reverse. There's no stop-and-go shifting . . . you quick-shift on the fly. And this ONE-LEVER control is exclusive with Tractomotive.

SMOOTHEST LOADING You get crowding action PLUS with a hydraulic torque converter drive that multiplies torque 350 percent. You quickly and smoothly load the toughest materials — no butting, no ramming, no engine stalls. And there's a scooping action, too, with the tip-back bucket. Result — heaping loads fast!

STRONGEST CONSTRUCTION The TL-20 is built to last with a one-piece welded frame and strong, pin-connected, planetary axles. Big lift and dump cylinders are out of the dirt and out of the way. Hydraulic system is protected with a full-flow micronic filter, as well as screen and magnetic filters. Unit construction makes servicing easy — saves hours on major repairs.

PLUS rear-wheel power steering . . . 4-wheel drive and 4-wheel power brakes . . . "Hi-Traction" differential . . . long wheel base for greater stability . . . rear-axle disconnect for free wheeling from job to job . . . 4-way adjustable seat for greater operator comfort . . . Allis-Chalmers diesel engine.

Ask your Allis-Chalmers dealer to show you the *extra* profit-making ability of the TL-20 — the very Latest In Big Loaders!

TRACTO — *a sure sign of modern design*

SOLD AND SERVICED BY YOUR ALLIS-CHALMERS CONSTRUCTION MACHINERY DEALER

Send For Free Descriptive Literature ▶

TRACTOMOTIVE

TRACTOMOTIVE CORPORATION • DEERFIELD, ILLINOIS

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☐ Please send TL-20 Literature
☐ Have salesman call

Name.....
Title.....
Company.....
Address.....
City..... State.....

New '57 Ford—

New Tilt Cab line offers six series ranging from 18,000-lb. GVW to 60,000-lb. GCW. Now, all the advantages of "cab forward" compactness, plus bigger payload capacity.

ONLY FORD GIVES YOU ALL THESE MODERN FEATURES

NEW Heavy Duty V-8 engines now have 4-barrel carburetion standard. Fresh-air intake with new thermostatic control optional on 302 and 332 V-8 engines. Dual exhausts also available.

NEW riding comfort! A completely new chassis suspension, roomy cabs with increased visibility, greatly improved riding and handling ease.

NEW power advances! New higher horsepower, new freer breathing, higher compression ratios, new Super-Filter air cleaner. New advancements from camshafts to carburetors.

NEW Driverized cabs—completely new, stronger, roomier, smarter! New wider full-wrap windshield. New inboard cab step, new Hi-Dri ventilation, new easy-to-read instrument panel!

NEW chassis strength! New frames, up to 13% stronger. New sturdier axles! New higher-capacity, easier-riding springs!

FORD TRUCKS COST LESS

LESS TO OWN

LESS TO RUN

LAST LONGER, TOO!

modern through and through

...to cost you less!

Modern with a purpose—that's the Ford truck story for '57. Modern through and through to give high-efficiency performance that costs you less!

And, thanks to volume production, Ford trucks cost you less right from the start. Look at the new Ford Tilt Cabs—in addition to being America's most advanced line of Tilt Cabs, they're lowest-priced!*

New Medium Duty models are designed for versatile low-cost operation. And Ford's new pickup with its Styleside body gives you the biggest loadspace in the half-ton field—*standard at no extra cost!*

For durability, there's new toughness everywhere—in longer-lived Short-Stroke engines, in stronger frames, in sturdier axles, in higher-capacity springs . . . more reason than ever why *Ford trucks last longer than any other leading make.*

One look tells you—here's something new, really new, in trucks. For the *full* story on what they can do for you, contact your Ford Dealer, or mail the coupon . . . today.

*Based on a comparison of factory-suggested list prices

MAIL THIS COUPON TODAY!

FORD Division of FORD MOTOR COMPANY, P. O. Box 658: Dearborn, Michigan

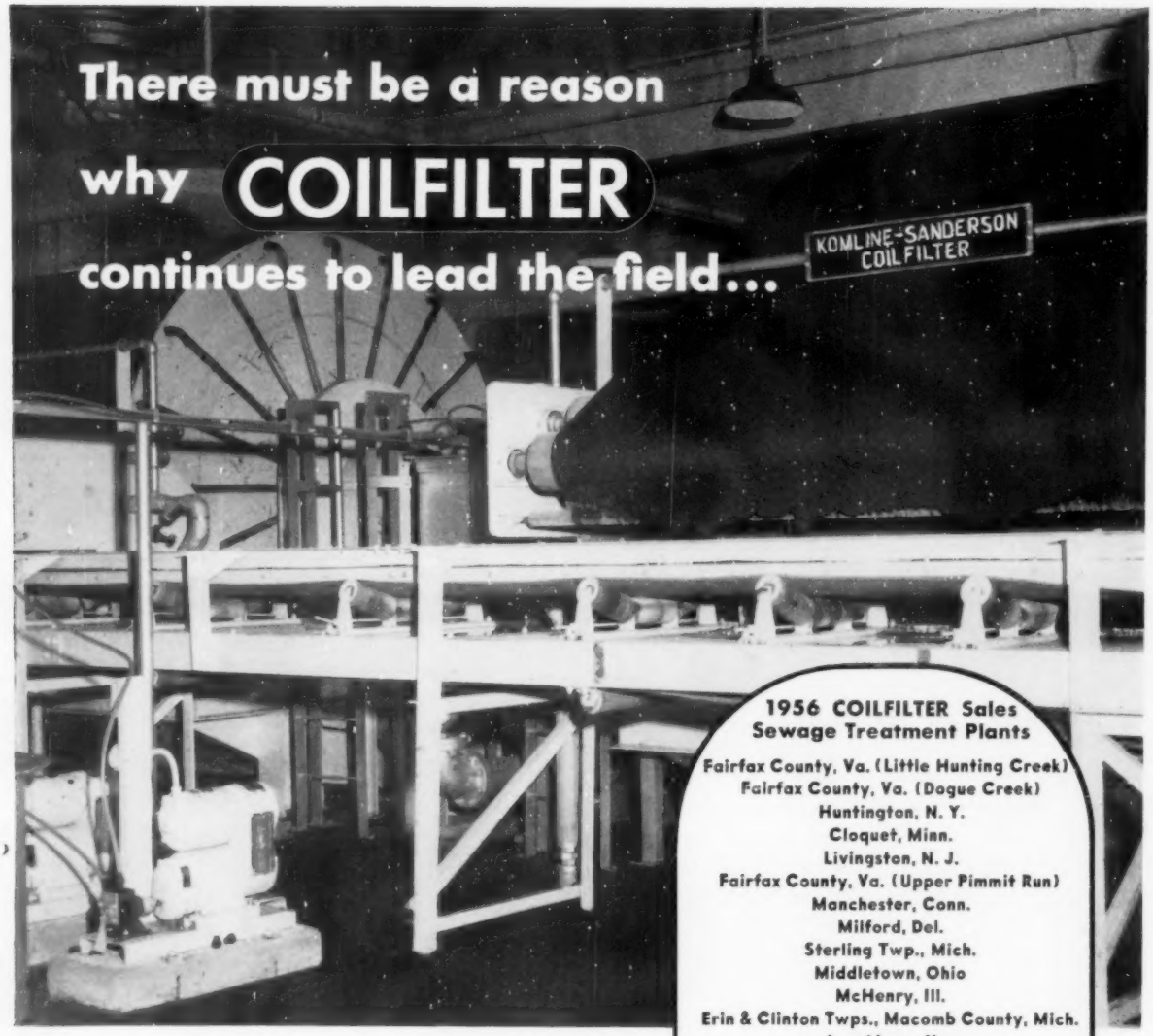
Please send me the following truck model literature:

☐ LIGHT DUTY ☐ MEDIUM DUTY ☐ HEAVY DUTY
☐ SCHOOL BUS ☐ TILT CAB ☐ TANDEM

Name_____

Address_____ State_____ E

City_____



1956 COILFILTER Sales
Sewage Treatment Plants

Fairfax County, Va. (Little Hunting Creek)
Fairfax County, Va. (Dogue Creek)
Huntington, N. Y.
Cloquet, Minn.
Livingston, N. J.
Fairfax County, Va. (Upper Pimmit Run)
Manchester, Conn.
Milford, Del.
Sterling Twp., Mich.
Middletown, Ohio
McHenry, Ill.
Erin & Clinton Twps., Macomb County, Mich.
Lynchburg, Va.
Clinton Twp., Mich.
East Liverpool, Ohio
Farmington, Ill.
Carrollton Subdivision, St. Louis Co., Mo.
Cayuga Heights, N. Y.
Collingswood, N. J.
Belton, Mo.
El Dorado, Kansas
Louisville, Ky.
Trenton, Mo.
Haddon Twp., N. J.
North Battleford, Saskatchewan, Canada
Nashville, Tenn.
Moundsville, W. Va.
Penn. State University, University Park, Pa.
Treasure Island, Fla.
Campbell, Ohio
Herrin, Ill.
Piqua, Ohio
Superior, Wisc.
High Point, N. C.
Montgomery Co., Ohio (Moraine Plant)
Greensboro, N. C. (So. Buffalo Creek)
Neenah-Menasha, Wisc.

Yes, there is a reason, in fact, many reasons, why COILFILTERS again in 1956 far outsold competitive filters in the municipal sewage treatment field. These reasons all add up to economical, dependable performance, ease of operation and extremely low maintenance costs.

KOMLINE-SANDERSON
ENGINEERING CORPORATION
Peapack, New Jersey

Manufacturers of COILFILTER *sludge vacuum filters*

Bucket teeth and ripper available at extra cost.

TEETH AT BOTH ENDS* BOOST PRODUCTION!

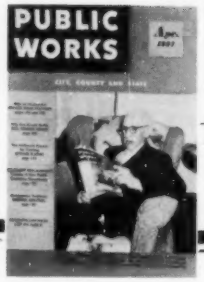
Production really steps up when this working team moves in—the Allis-Chalmers HD-6G tractor shovel with replaceable bucket teeth and rear-mounted ripper. Here's a job-proved combination engineered by the company that pioneered modern tractor shovels for the construction industry.

When the hydraulically controlled ripper bites in, even hard blacktop has to give. With the help of teeth at the front end, too, tough material is loosened and broken up for fast, easy loading—a full bucket every time.

You get more work done in less time because the heavy-duty HD-6G is designed for tough jobs. With 72 net engine hp and six-truck-wheel stability, it offers performance that means efficient production every hour on the job.

These important advantages are also available on bigger Allis-Chalmers tractor shovels—the 2½-yd HD-11G, the 3-yd HD-16G, and the 4-yd HD-21G . . . to help you meet the needs of your tractor shovel jobs. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*



LEADERS IN PUBLIC WORKS

A. Prescott Folwell has been one of the leaders in the public works field for nearly 60 years as well as being a grand gentleman in every respect. A graduate of Brown University in the class of 1885, he took further work at MIT and in 1907 was granted his Sc.D by Lafayette. Following several years of field engineering, he served as professor of Municipal Engineering at Lafayette from 1897 to 1906. During this period he published "Sewerage," the first modern text on the subject. Widely used by colleges, this book had a useful life of nearly 40 years. Later he published other textbooks, including "Water Supply" also largely used. It is a tribute to the quality of material in these books that study of them is still rewarding to the engineer. So many editions of these books were published that they are, fortunately, still widely available, especially "Sewerage."

In 1906 he became engineering editor of MUNICIPAL JOURNAL, now PUBLIC WORKS, and in January, 1907, joined the organization, full time, as editor. He continued in this post for more than 40 years, providing a leadership in engineering writing, reporting and interpretation which has helped thousands of engineers. After his retirement as active director of editorial policies, he continued preparation of Public Works' Digests through March, 1957; and he will continue to write from time to time special articles and material based on his broad knowledge and fine engineering background.

The roster of his various activities is too long to list here, but it should be noted he was one of the founders, and an early president, of the American Society for Municipal Improvements, principal forerunner of the present American Public Works Association. At present, Mr. Folwell lives in Vienna, Va., with one of his two daughters, having moved there a few years ago from Montclair, N. J., his longtime home. Mrs. Folwell died during the past winter.

Mail will reach Mr. Folwell at Box 343, Vienna, Va., and he will be happy to hear from his former students and his many friends. He remains remarkably young, both physically and mentally, and writes a firm, strong hand. He spent a portion of the winter in Florida, as he has for many years, but by the time this is published will have returned to Virginia.

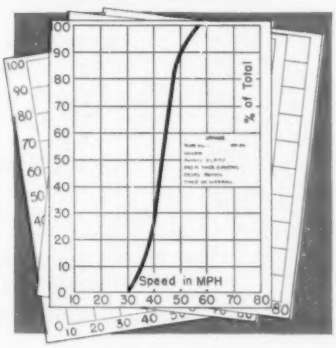
Connecticut's forward-looking State Highway Department is among those engaged in a comprehensive program of setting up realistic speed zones on today's highways for today's cars.

ELECTRO-MATIC® RADAR assures realistic speed limits . . .

The first essential in the process of setting zone speeds is the determination of current speed patterns. The Electro-Matic Radar Speed Meter is now the accepted means by which traffic engineers obtain speed characteristics of vehicle flow on all types of highways.

Highly accurate under all conditions of traffic and weather, it is inconspicuous and operates without contact-making devices on the road surface. The Meter is easily portable and requires only one man for operation. It can be set up in less than three minutes. Operation is on 6 Volt or 12 Volt battery or 120 Volt A.C.

A Graphic Recorder provides a permanent record for study and analysis leading to the preparation of speed distribution curves and other data essential to instituting a realistic system of speed zoning that goes hand in hand with modern enforcement techniques.



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AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INC., NORWALK, CONN.

For more information on the Radar Speed Meter, request Bulletin R-112

NEW...and full of BIG features for you!

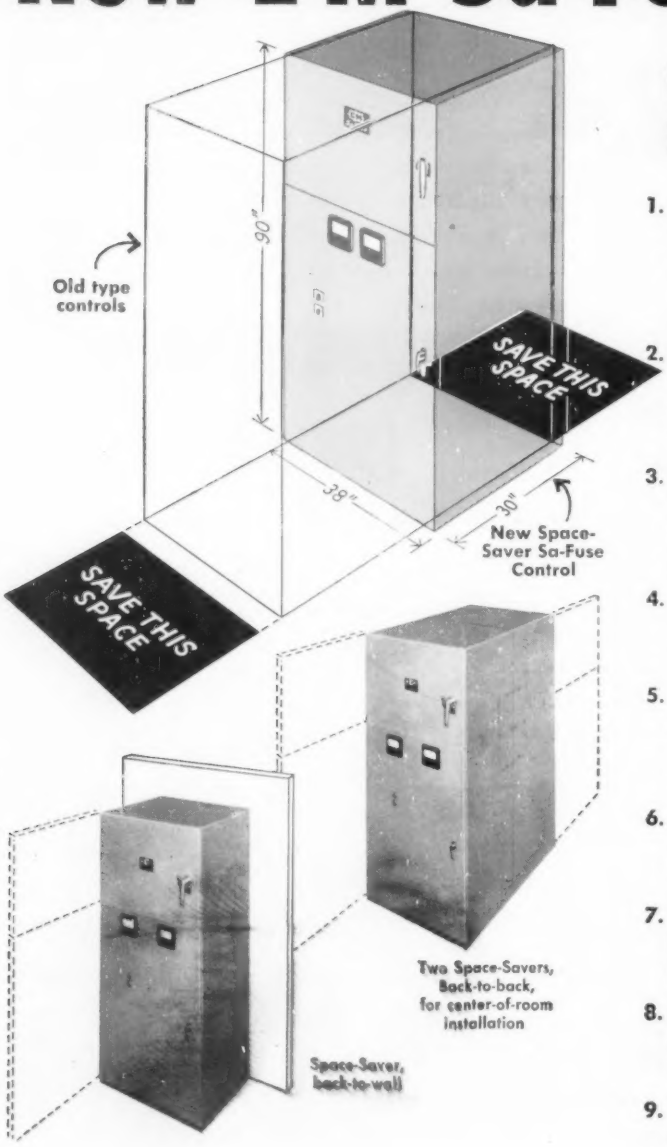
NEW

Space Saving
Safety
Easy Access
Easy Installation

CHOICE of Air or Oil Switch

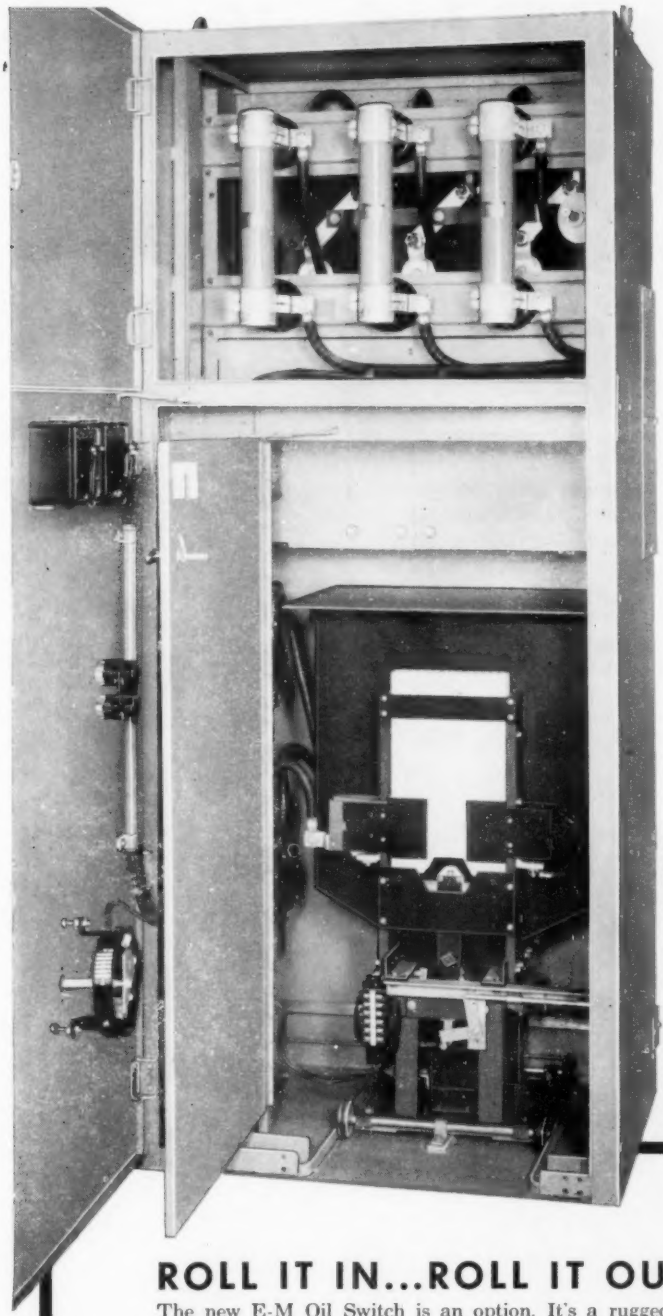
YOU GET THEM ALL IN THE

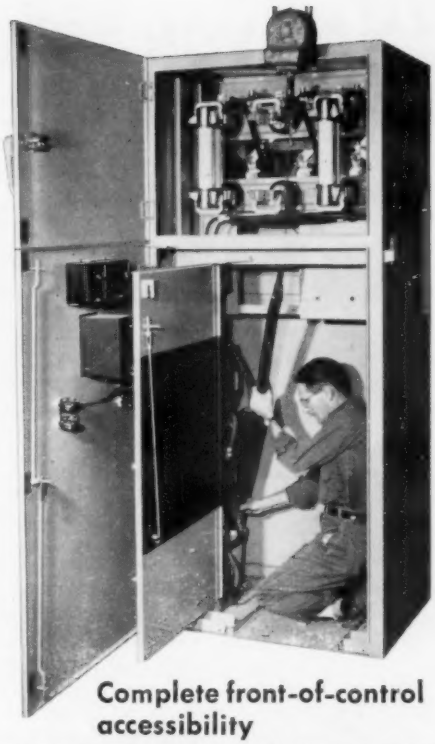
New E-M Sa-Fuse Control



✓ *Check these outstanding* SA-FUSE Features:

1. **CONTROL DEPTH CUT IN HALF.** The new Space-Saver SA-FUSE Control is only *half as deep* as old type controls. Space-Savers require no wasteful rear aisle. You get almost *twice as many* new Space-Savers into any given area.
2. **COORDINATED MOTOR PROTECTION.** Thermal relays and current-limiting fuses work together to protect against sustained overloads and short circuits.
3. **POLARIZED FIELD FREQUENCY RELAY,** invented by E-M, gives simplest, most foolproof, and most completely effective "conscious" control of synchronous motors.
4. **"SPOT CHECK" DISCONNECT SWITCH.** A glance at ganged disconnect switch quickly confirms that its blades are open and *grounded.*
5. **FOUR-WAY SAFETY INTERLOCK.** Personnel are guarded by interlocking between a-c contactor, disconnect switch door, disconnect switch, and contactor compartment door.
6. **ISOLATED HIGH VOLTAGE COMPARTMENT** is separated from low voltage chamber by a key-locked, hinged relay panel.
7. **FRONT-CONNECTED LOW VOLTAGE COMPONENTS** are mounted on front of hinged relay panel enclosing a-c contactor.
8. **RUGGED STEEL CABINET** is fabricated from heavy gage steel plate for extra strength and rigidity.
9. **VAULT-TYPE LOCKING.** Main door has 3-point locking for safety and freedom from vibration.



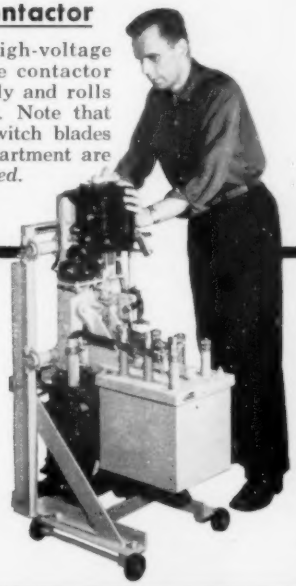


Complete front-of-control accessibility

Cable pulling is easier in the big, roomy high-voltage compartment. Power cables enter through top or bottom of cabinet.

Here's Sa-Fuse with roll-out air-break contactor

Isolated in the high-voltage compartment, the contactor disconnects easily and rolls out for servicing. Note that the disconnect switch blades in the fuse compartment are open and *grounded*.



ROLL IT IN...ROLL IT OUT!

The new E-M Oil Switch is an option. It's a rugged oil switch specially designed for motor starting duty. Control transformer is mounted with it on roll-out assembly.

When you're thinking about motor controls, be sure to ask your E-M Sales Engineer about SA-FUSE. He will be glad to give you details about the better motor control. Also, write today for your personal copy of the informative SA-FUSE brochure, No. 1133.

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ELECTRIC MACHINERY MFG. COMPANY

Minneapolis 13, Minnesota

Originators of the safety gang disconnect high-voltage fuse control

Helps you take a big bite off construction costs!

New idea in "job-applied" pump selection shows how to speed construction projects—keep "on schedule"—by moving more water efficiently from job to job.

Barnes engineers developed a broad line of heavy-duty pumps that meet practically all liquid-moving applications contractors encounter—in excavations, mines, on highways and general construction projects.

Then we went a step further. To help you avert costly delays we charted the operations you perform regularly . . . and matched them up with the pumps that do those jobs better, faster, at lowest cost.

It's all in a handy *Construction Pump Selector* we offer you free. Follow the key numbers and stay on the track to extra profit on every project!

Ask your Barnes Pump distributor or write us today, Dept. V-47.

BARNES MANUFACTURING CO., Mansfield, Ohio

BARNES PUMPS SPEED

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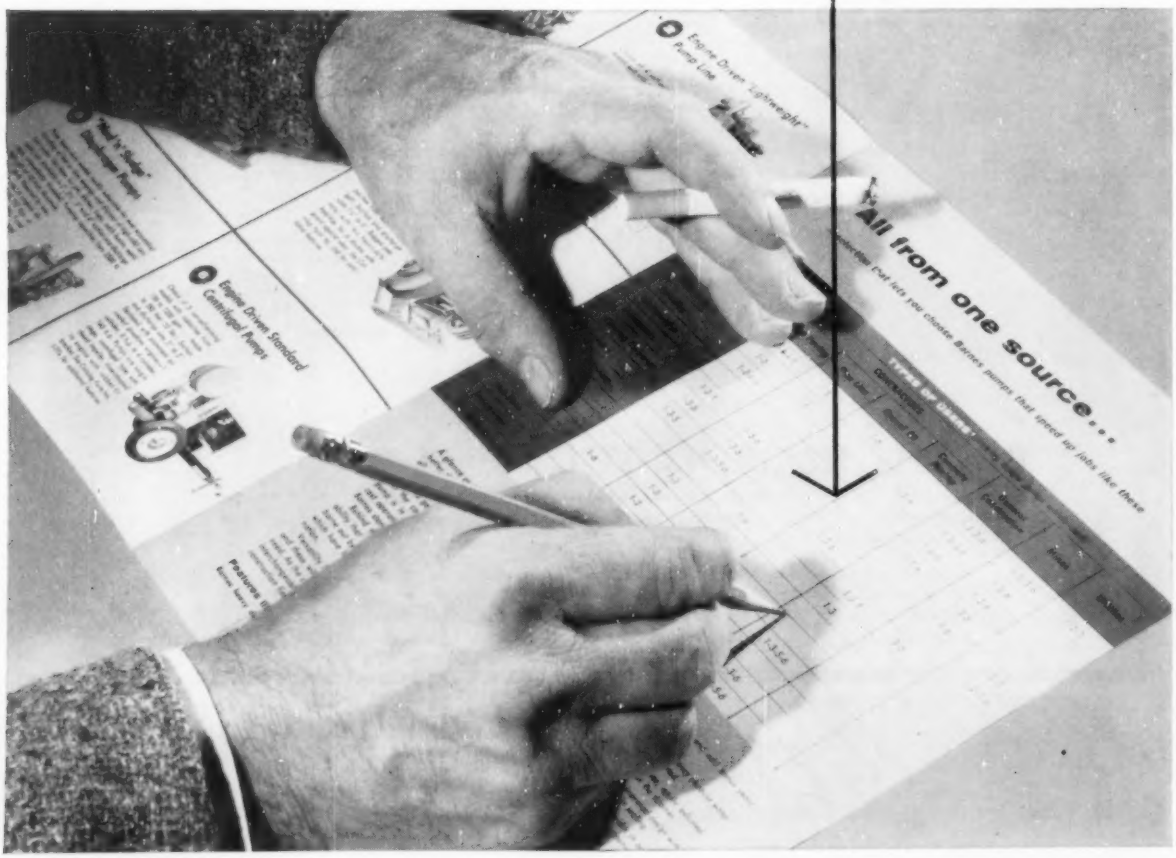


Here's the Equipment That Really **Stretches** Maintenance Budgets!

AIRPLACO® CONCRETE GUNNING EQUIPMENT

For maximum efficiency, speed and economy, public works officials are turning to the new AIRPLACO Portable Concrete Gunning Rig. From simple road, curb and street repairs to major concrete reconstruction projects on bridges, docks, sewers, reservoirs and many other structures, you can do the job faster and at far less cost with the AIRPLACO Rig.

The AIRPLACO Rig consists of the SAND-LOADER for rapid loading of sand; the MIX-ELVATOR* for automatic proportioning, continuous mixing, elevating and screening; and either the NUCRETOR* or BONDACTOR* for the actual application of the concrete. (The NUCRETOR or BONDACTOR is available separately.) The entire unit can be towed easily by your pick-up or compressor truck. No set up time required.

Investigate AIRPLACO concrete gunning equipment now.

*Registered Trade Names

Whatever Your Specific Requirements, There's an AIRPLACO Concrete Gun to Do the Job

AIRPLACO concrete gunning equipment is available in a wide range of sizes to fit your production and job requirements from ½ to 7 cubic yards of aggregate per hour, and using air compressors with 75 to 600 CFM capacity.

FREE Complete Line Catalog!

See your AIRPLACO distributor or write today for your complimentary catalog. Here are the answers to many of your questions about AIRPLACO equipment and job applications.

AIRPLACO® AIR PLACEMENT EQUIPMENT CO.

1013 WEST 24TH ST. KANSAS CITY 8, MO.

MANUFACTURERS OF ADVANCED DESIGN CONCRETE GUNNING, MIXING, GROUTING AND SANDBLASTING EQUIPMENT.

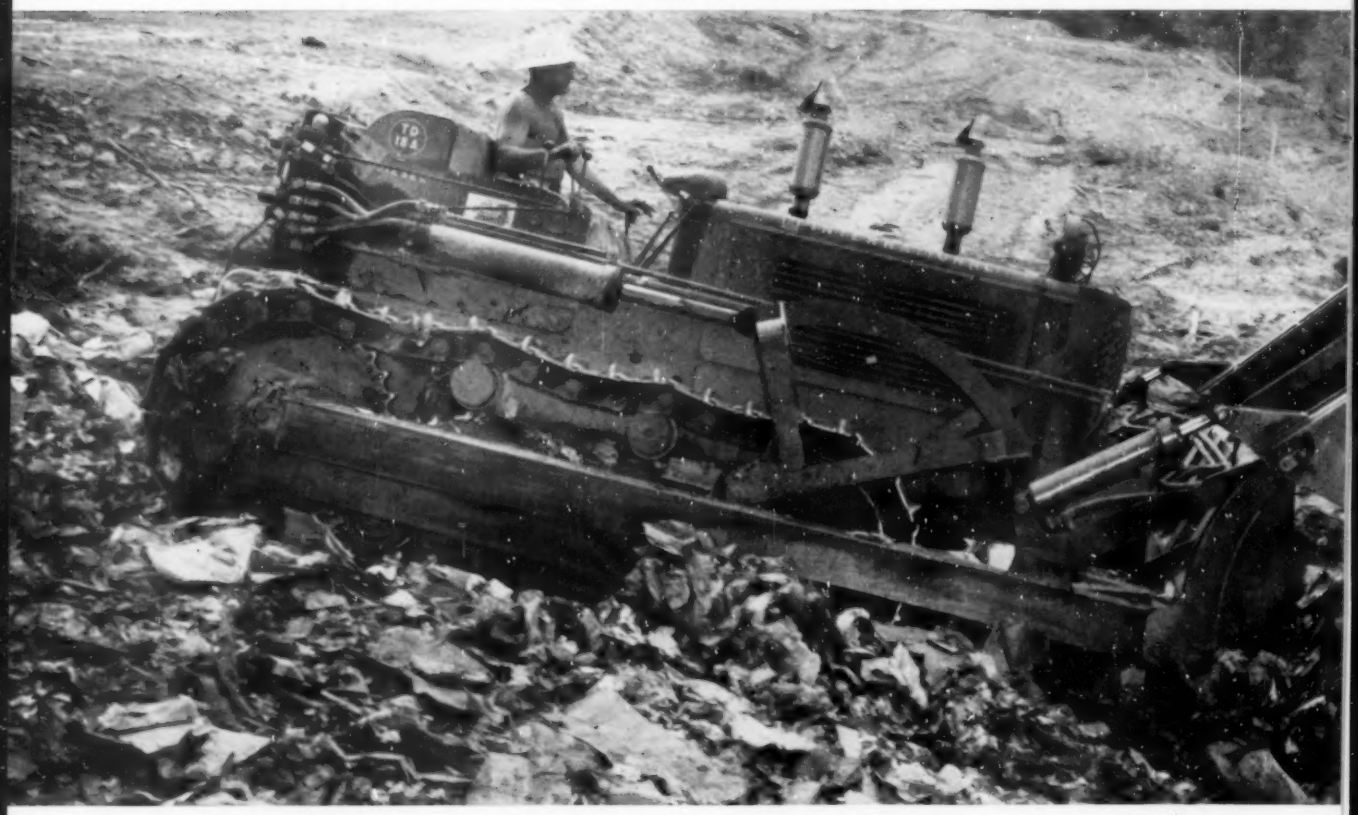
DOCK and HARBOR REPAIRS

SEWER RESTORATION

HOW SYRACUSE

turns wasteland into high—

— AND CUTS



...and 4-in-1 versatility cuts municipal costs too!

Borough of Brookville, Pennsylvania, (population 4,600) owns this International Drott TD-9 Four-In-One. It's shown, operating in Bullclam position, spreading cover on refuse. Besides sanitary landfill duties, the Four-In-One is available for doing a wide variety of excavating, loading, grading, 'dozing, and other jobs for Brookville!

Eight acres of lowland in Syracuse, N. Y., will become an area of beautiful and highly-desirable homesites upon completion of this sanitary landfill.

Refuse and earth are spread and compacted, layer upon *sanitary layer—odor-free, rodent-free, smog-free.* Soon this will be a beauty spot where houses rise, roses bloom, children play, neighbors picnic.

In addition to civic improvement values, Syracuse residents are handed a big reduction in waste-disposal costs—by each of *seven* International Drott outfits the city operates on *three* landfills!

No other outfits built can spread, crush, cover, and seal rubbish and refuse like an *exclusive* International Drott Bullclam or Four-In-One.

Bullclams are preferred by larger cities needing the full-time services of *specialized* big-capacity sanitary landfill equipment. Four-In-One's are the choice of communities that can profit from

—value homesites

TAXES TO BOOT!

Here's how the Syracuse Department of Public Works is raising lowland five feet, with sanitary landfill—to meet adjacent grade. They use another International Drott unit to clear land; and to excavate trench about 18 feet wide, 18 feet deep, and 500 feet long—leaving a solid earth strip, 25 feet wide, between trenches. Here, the Bullclam is shown spreading earth cover with accurate dozer-like action—over a fill section that's nearly completed.

Using the famous Drott ramp method, this TD-18A Bullclam spreads refuse in even four-foot layers—covers each layer with eight inches of earth—caps the fill with 2½-foot earth cover. Operation handles 170, 20 cu yd packer loads of refuse daily, 5 days a week—continues even in 18° below zero, or colder, weather! Bullclam action provides accurate spreading and covering!

versatility unlimited—from the use of integral Bullclam action, *plus finger-tip-touch-availability of excavating, loading, and bull-dozing actions!*

Compare International Drott Bullclam or Four-In-One advantages to anything else on the market—for man-saving, dollar-stretching efficiency. Prove the year-'round all-weather capabilities of these heavy-duty units for uninterrupted waste-disposal service. See your International Drott Distributor for a demonstration.

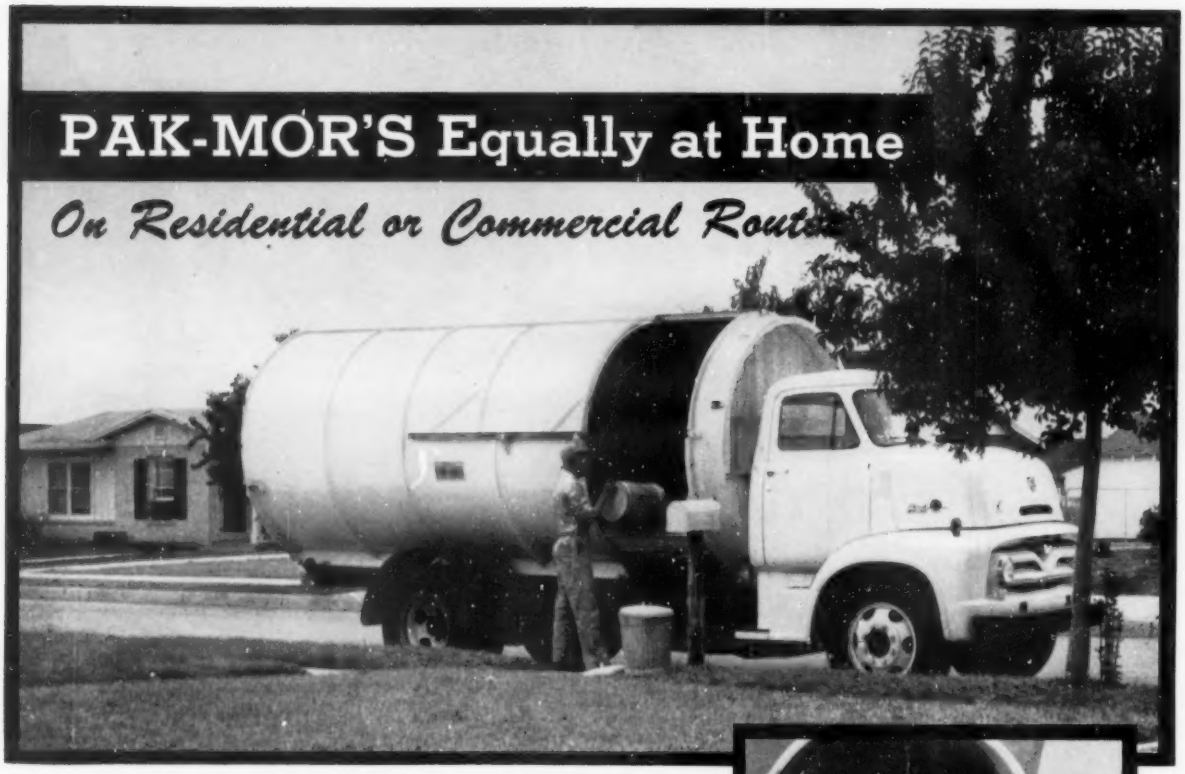
Here's how Syracuse uses exclusive Bullclam compactor-plate down-pressure—to "iron-down" the "cover" and provide a positive seal over the refuse. The whole area soon will be ready for residential development.

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

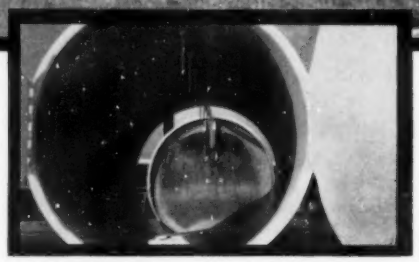
PAK-MOR'S Equally at Home

On Residential or Commercial Routes

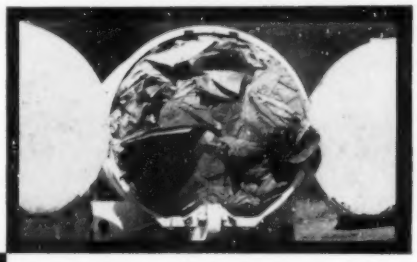


COMMERCIAL AND RESIDENTIAL routes make up the majority of work done by a sanitation department. So, it makes good sense to buy the type body that can handle both jobs best. PAK-MOR's proven features make it the ONE refuse body that can do both jobs equally well. PAK-MOR's large unlimited loading area allows quick loading — without flattening or folding bulky objects, just throw them in, Direct Compaction of Paker Plate does the rest. At heavy stops, material can be thrown directly into PAK-MOR's barrel — a real advantage over limited hopper space and numerous packing cycles. PAK-MOR speeds up pickup-time, enables you to make more stops — more quickly and cover routes faster.

DIRECT COMPACTION of Packer Plate traveling full length of barrel breaks down load and packs it densely under 50,000 pounds of pressure. Finger Stays provide Positive Retention to hold load in barrel and prevent fall back into loading area. Reason why PAK-MOR picks up heavier loads faster and goes farther on every route. PAK-MOR's heavier loads allow you to spend more time on the pickup route and less time traveling to and from the dump.



FINGER STAYS (TOP OF BARREL) PROVIDE POSITIVE RETENTION OF LOAD.



PAK-MOR'S DIRECT COMPACTIONS PACKS HEAVIER LOADS.

BECAUSE OF PAK-MOR'S few moving parts, all accessible, maintenance and lubrication are handled quickly and easily. Ask for a PAK-MOR demonstration before you buy. There's a PAK-MOR Distributor in your area who can show you how PAK-MOR can do a better job for you.

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This imposing 2,000,000 gallon PDM Radial Cone Elevated Steel Tank at Muncie, Indiana typifies the progress made in municipal water storage since the *first* elevated steel tank, built by Pittsburgh-Des Moines at Scranton, Iowa nearly sixty years ago (and serving well today).
May we quote on your requirements?

Write for our latest Elevated Tank Brochure

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DES MOINES (8).....943 Tuttle Street
DALLAS (1).....1247 Praetorian Bldg.
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EQUIPMENT and MATERIALS

FOR YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Construction Pump Bulletin Contains Selector Chart

517. A ready-reference chart enabling builders, contractors and maintenance men to select the type of pump best suited to specific construction jobs is one of the features of the bulletin available from Barnes Mfg. Co., Mansfield, Ohio. Check the reply card for information on the right pump for dewatering, sprinkling, equipment cleaning, sewer lines and tunneling.

Slide Rule For Chemical Feed Calculations

627. A very handy chemical feed calculator is available from Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. Pounds per million gallons, grains per gallon and grains per gallon of CaO from lime are several of the calculations that can be made. Check the reply card today.

Light Duty Trucks For Construction and Maintenance

628. Pickup and stake body trucks are fully described in literature from Ford Div., of Ford Motor Co., Dearborn, Michigan. Pickups are available in 6½, 8 and 9-ft. lengths. They come in standard colors and with either a 6 or V-8 engine. Rigid tailgate and steel corner posts add to the over-all body strength. The stake body trucks come in 6½, 7½ and 9-ft. lengths. These units also come in 6 or V-8 engines. Check the reply card for full information.

Armco Steel Building Catalog

629. An attractive well-illustrated catalog on steel buildings for highway construction and maintenance departments is available from Armco Drainage & Metal Products, Inc., Middletown, Ohio. Check the reply card for information on types, erection, accessories and applications of these buildings.

Book on Office Photocopying

630. A 16-page, full color book on office photocopying for every type of business, professional and institutional use is available from American Photocopy Equipment Co., 1920 West Peterson Ave., Chicago 26, Ill. Check the reply card for details on this equipment.

Engineering Guide on Mercury Street Lighting

640. Technical data on mercury lamps applicable to general lighting service, operating characteristics of the mercury vapor lighting system and economic evaluation of lighting systems designed for equal lighting results are several of the sections covered in catalog from Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio. Check the reply card.

Tilting Side Discharge 3½-Cu. Ft. Concrete Mixer

632. A 4-page catalog describing the 3½-cu. ft. concrete mixer has been released by Kwik-Mix Co., Port Washington, Wisc. The well illustrated catalog covers structural and operational features. Check the reply card.

Booklets on Salt-Soil Stabilization

633. Five booklets entitled: general principles of salt-soil stabilization, plant mix and road mix procedures, crushed rock roads, stabilizing gravel roads and stabilizing shoulders are available from International Salt Co., Inc., Scranton, Pa. Check the reply card.

Truck Loader For Municipal and Highway Use

634. An illustrated bulletin describing the M-B truck loader operation and specifications is available from the M-B Corp., New Holstein, Wisc. Check the reply card for complete information.

Standard Rate Recorder for Water Meters

635. This instrument detects presence of leaks, converts any standard meter to a demand meter and saves on meter installations. Check the reply card or write F. S. Brainard & Co., 246 Palm St., Hartford 12, Conn. for full information.

Crawler and Wheel Tractors

636. A handy pocket bulletin that describes Oliver crawler and wheel tractors has been released by The Oliver Corp., 400 W. Madison St., Chicago 6, Ill. Check the reply card for specifications on the tractors and their attachments.

Etnyre Bituminous Distributor Catalog

637. A 6-page catalog presents distributors for heating and applying asphalt, tar, emulsion or road oil. Gives full details and specifications plus auxiliary equipment and styles of units. Check the reply card or write E. D. Etnyre & Co., Oregon, Ill.

Asbestos-Cement Sewer Pipe With the Ring-Tite Coupling

638. A catalog describing transite asbestos-cement sewer pipe with the Ring-Tite Coupling is available from Johns-Manville Sales Corp., 22 East 40th St., New York 16, N. Y. Design, installation, operation and maintenance advantages are covered. Check the reply card.

Manual on Concrete Pavement for Parking Areas Raw Sewage and

639. Concrete pavement design, joints, pavement costs, suggested specifications and tables for required thickness, load capacity and spacing of dowels are sections covered in this catalog from Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill. Check the reply card.

Sludge Pump Catalog

626. Specifications, graphs on the determination of pump sizes, and illustrated photos of pumps are included in catalog from Chicago Pump Co., Sewage Equipment Div., 622 Diversey Parkway, Chicago 14, Ill. Check the reply card.

Bulletin on "Chem-Weld" Drain Pipe

642. A two-color bulletin describing the new features and methods of applying "Chem-Weld" drain pipe is available from the Southwestern Plastic Pipe Co., Mineral Wells, Texas. Included are a number of illustrations picturing the chemical fusion of the plastic joints. Check the reply card.

Attachments For Ford Tractors

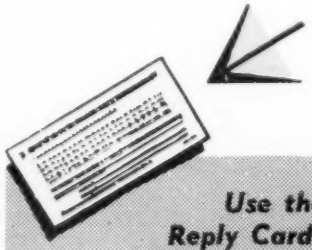
643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

Catalog on Incinerator Enclosures

644. A catalog on municipal incinerators that include sections on types, chambers, hoppers, gates, instruments, arches and walls, and dampers and doors is available from M. H. Detrick Co., 111 West Washington St., Chicago 2, Ill. Check the reply card for full details.

Diesel Powered Crawler Tractor Shovels

645. The matched attachments that are designed specifically for the Allis-Chalmers HD1 11G and the HD-6G crawler tractor shovels are described in literature from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisconsin. Check the reply card today.



Use the Reply Cards For Prompt Service

NEW 1½-YD.

CASE-TERRATRAC TRACTOR-SHOVEL

Moves up to 40% more yardage per shift!

A free demonstration will quickly convince you that this revolutionary 1½-cu. yd. Case-TerraTrac tractor-shovel will *move up to 40% more yardage per shift* than any other machine in its price range.

You not only get bigger payloads faster with torque-converter drive . . . you also turn and maneuver faster with a new *counter-rotating* hydraulic transmission that permits *fast 360° power-turns* within the length of the machine — with one track driving forward and the other in *reverse*. Instant power-shifting also enables operator to change speeds and direction "on-the-go"—without clutching, braking, or stopping to shift gears.

See this spectacular higher-speed, big-yardage producer now at your Case industrial dealer's . . . or mail handy coupon below for free literature on tractor-shovel sizes best suited to your needs and budget.

Check these advanced features no other crawler-loader can match

- 80 HP Diesel plus torque-converter drive
- Automatic power-shift transmission . . . power-brakes
- 4 forward and reverse speed ranges — from 0 to 7.0 MPH
- Effortless power-steering with both hand and foot controls
- Torsion-bar equalizers permit full track oscillation . . . keep bucket level for smooth cuts
- 45° bucket roll-back . . . 9'6" dump clearance
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To order these helpful booklets check the reply card opposite page 68.

NEW LISTINGS (Cont.)

Pollution-Proof Outdoor Drinking Fountain

649. An outdoor drinking fountain so designed that contamination by cross connections or back siphonage is not possible is fully described in a 4-page bulletin. Features neat appearance, easy installation. Write Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio, or use reply card.

Water Tanks, Reservoirs and Standpipes

631. Data on steel water tanks, reservoirs and standpipes of all capacities are included in literature available from Graver Tank & Mfg. Co., Inc., East Chicago, Ind. These units are fabricated and erected by the company. Check the reply card.

The Ace Method of Water and Sewer Pipe Cleaning

231. A 24-page bulletin has been issued by Ace Pipe Cleaning, Inc., 3513 East 18th, Kansas City, Mo. How sewers and water lines are cleaned and the equipment used is completely outlined. Also the 1955 floods in New England are covered by pictures and stories of how Ace Pipe Cleaning helped restore water and sewer lines. Check the reply card.

Trickling Filter Systems For Small Sewage Plants

506. Trickling filter systems for the small sewage treatment plant, such as required for isolated, institutional, industrial and residential developments, are detailed in a 24-page manual available from Yeomans Brothers Co., 2000-1 North Ruby St., Melrose Park, Ill. In addition to the trickling filter distributors the catalog also gives specifications and suggested sizes for the Spiragester. Check the reply card for Manual 6769.

Crezon Plywood Signs Have Long Life Expectancy

641. Crezon overlaid plywood signs are described fully in literature available from Crown Zellerbach, San Francisco 19, Calif. Material is strong and rigid, resists bending or tearing loose from the pole and there's neither checking nor blistering from heat or freezes. Check the reply card today.

Concrete Pressure Pipe

646. Literature on Cen-Vi-Ro concrete pressure pipe for storm sewers, highway culverts, high type sanitary sewers, and for pressure water transmission lines is available from Southern Cen-Vi-Ro Pipe Division of Vulcan Materials, P. O. Drawer 155, Birmingham, Ala. Check the reply card for specifications and data.

Literature on Pipe Pushers

647. Pipe pushers are fully described in literature from Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo. Types, models and operation of the pushers are covered. Check the reply card.

How to Treat Holes in Posts and Timbers

267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Write Greenlee Bros. & Co., Rockford, Ill., or check the reply card.

Equipment for Cleaning Water Mains

648. Twelve-page Catalog 55-B describes methods for cleaning water mains and gives details of power drives and tools for hydraulic and mechanical cleaning operations. Flexible Inc., 3786 Durango Ave., Los Angeles 34, Calif.

●

WATER WORKS

Waterstops For Expansion and Construction Joints

19. A polyvinylchloride waterstop "Durajoint", that is resistant to extreme waterhead pressures, tensile strength of not less than 1900 psi, chemically inert and available in easy to handle 50 ft. coils is described fully in literature from W. R. Meadows, Inc., 24 Kimball St., Elgin, Ill., or Tecon Products Inc., 304 S. Alaskan Way, Seattle 4, Washington.

Elevated Tanks and Other Storage Facilities

32. How engineers' designs and standard AWWA specifications are followed for fabrication and erection of water storage facilities are described in color illustrated booklet. Address the Darby Corp., Kansas City, Kans.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif. furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

(Continued on page 37)

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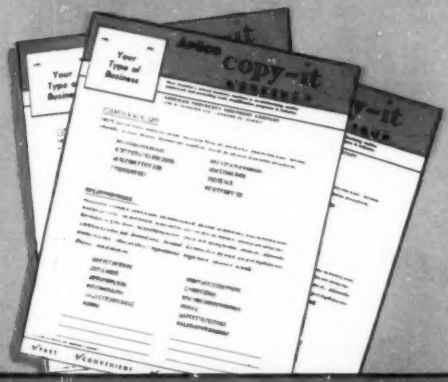

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To order these helpful booklets check the reply card opposite page 68.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Helpful Reference on Swimming Pool Equipment

87. A complete reference catalog of swimming pool supplies, chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the reply card.

What You Should Know About Pipe Locators

94. A new, up-to-date operating manual for pipe detecting instruments has been made available by the Computer-Measurement Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make pipe detector. To get an copy just check the reply card.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

To order these helpful booklets check the reply card opposite page 68.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 64-page Catalog 905. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use card or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

What You Should Know About the Centriline Process

197. The Centriline method for cement mortar lining water mains 16" thru 144" in place to stop leaks, prevent corrosion, increase carrying capacity and decrease pumping costs is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the reply card.

Valuable Information on Water And Waste Treatment Instrumentation

229. Helpful data on pneumatic instrumentation, flow measurement, recording controllers and rapid sand filter control systems are included in a 16-page Bulletin 1-15. Get this from the Foxboro Co., Foxboro, Mass., or by checking the handy reply card.

Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet "Horton Elevated Steel Tanks of Large Capacity," Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspheroidal tanks of 1,000,000 to 3,000,000 gal. is included in this really handsome bulletin. Check reply card for your copy.

Use The Reply Card

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wisconsin.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 488 Madison Ave., New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the reply card for your request.

Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwaukee 14, Wis. Detailed specifications are included. Check the reply card for your copy.

Diesel Engines For Municipal Power Needs

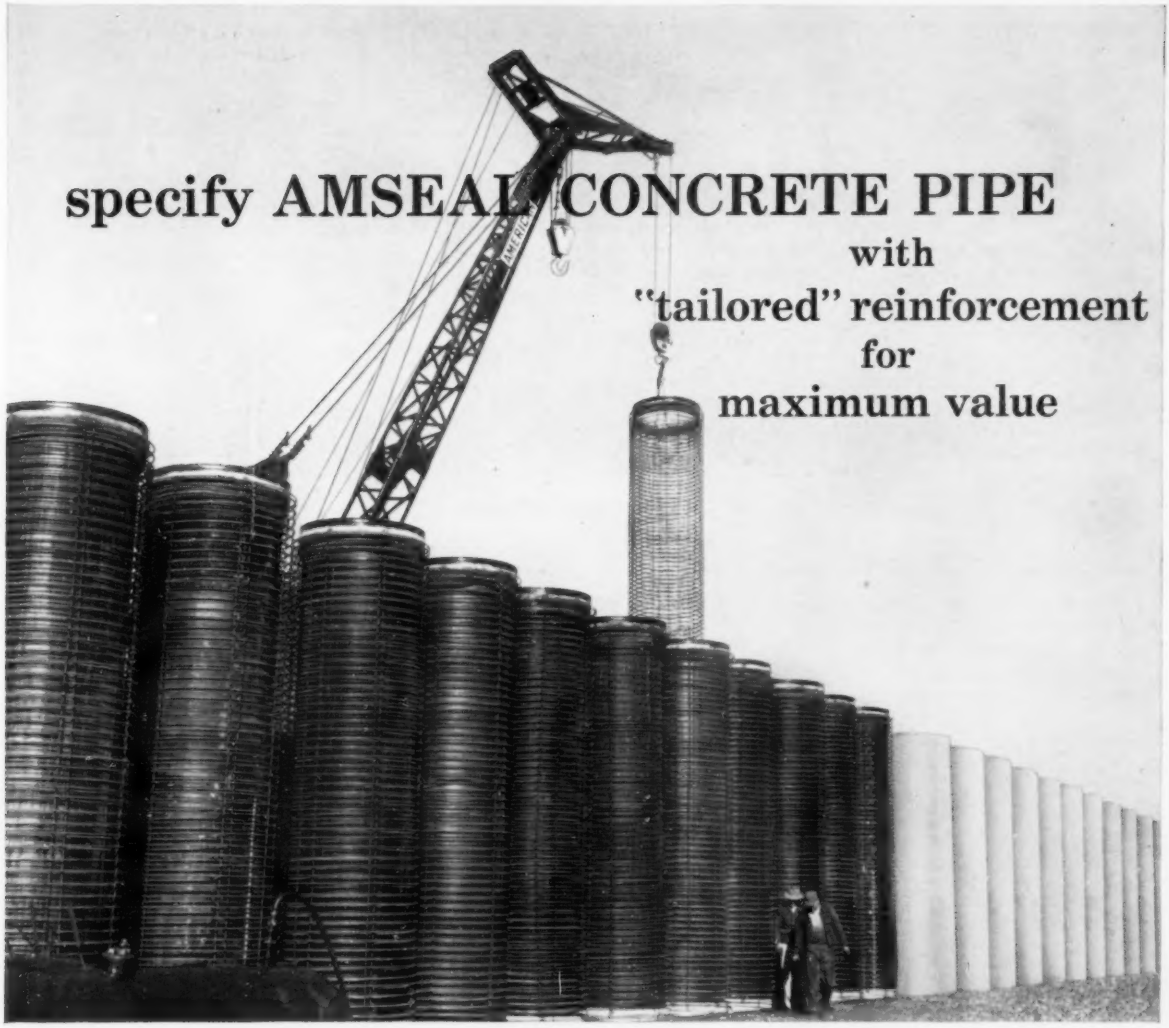
359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the reply card.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Lube Jack Co., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included. Check the reply card.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.



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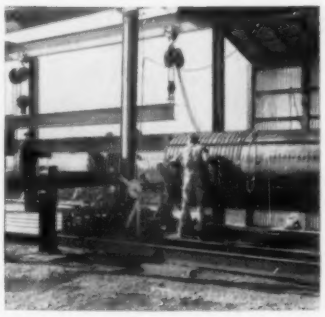
The vital steel "backbone" of concrete pipe is a large part of its cost. Savings are possible with AMSEAL because its reinforcing is custom designed for each specific job. Precision machines make full length "cages" by winding steel spirally with effective control of diameter and spacing. A rigid backbone structure is formed by welding properly positioned longitudinal steel rods to the spirals.

The widely-used AMSEAL rubber and steel joint can mean freedom from worry about leakage or infiltration. Long 16-foot lengths mean less joints and faster installation.

Specify AMSEAL Concrete Pipe for life-long economies on your job.



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101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

Welded Steel Pipe From 6 to 10-3/4 Inches in Diameter

382. High grade, butt welded steel pipe in diameters from 6 to 10-¾ inches, 10, 12 and 14 gauge and 20, 30 and 40 ft. lengths is described in literature available from Valley Mfg. Co., Valley, Nebr. This lightweight, plain or asphalt coated, choice of joints pipe is ideal for water and gas lines, well casings and heat exchanges. Check the reply card.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing. Check the reply card for this interesting literature.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipe lines in place from 4" to 144" in diameter, with both the Tate process and the Centriline process offered by Pipe Linings, Inc., 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Residual Chlorine Recorders For Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Check the reply card today.

Zeolite Water Softeners End Hard Water Troubles

587. A 20-page catalog on Permuit water softeners has been released by The Permutit Co., 330 West 42nd St., New York 36, N. Y. Schematic diagrams, chemical reactions, operation of the water softener and specifications are some of the sections covered. Check the reply card today.

Diatomite Filters in Water Filtration

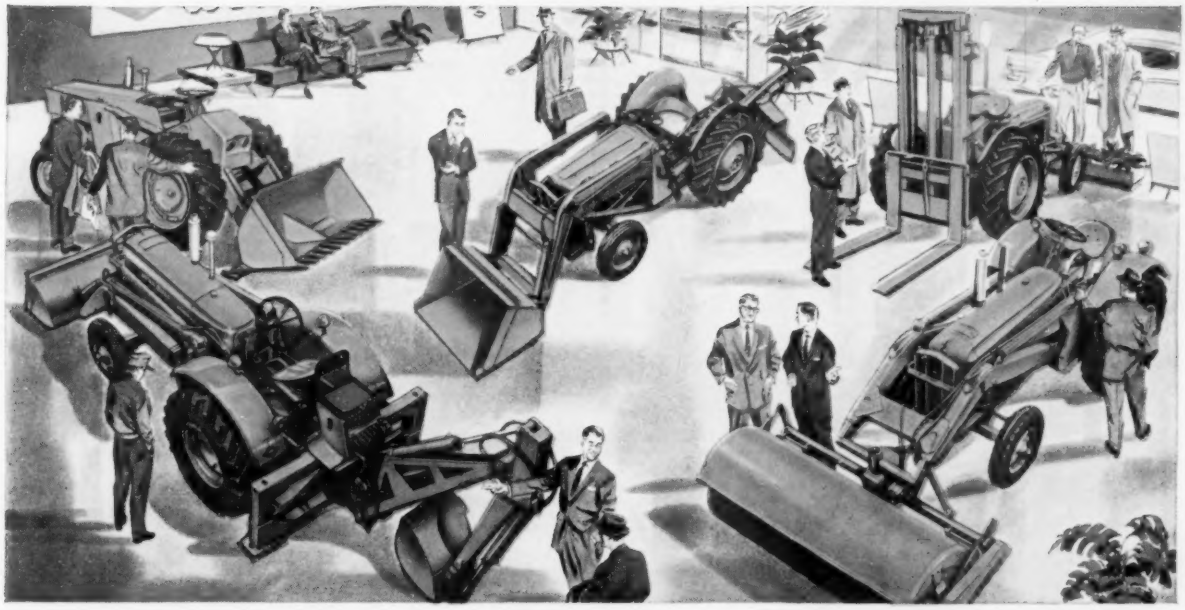
596. A new line of IWF diatomite filters is featured in this 10-page Bulletin 651 by the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. The IWF is ideal for medium and small town water supplies and the bulletin provides installation drawings, sectional views and operational sketches. Check the reply card for your copy of this helpful bulletin.

Manhole, Water or Gas Valve Box Locator

603. A valve box locator or manhole finder is available from Aqua Survey & Instrument Co., 2012 Leslie Ave., Cincinnati 12, Ohio. Rugged and compact with no wires, batteries or switches, the Aqua box locator should be in every service car. For more information and price, check the reply card.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.



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Division of Massey-Harris-Ferguson, Inc.

16-D Quality Avenue **Racine, Wisconsin**

To order these helpful booklets check the reply card opposite page 68.

"Arctic Boy" Portable Water Coolers

432. Descriptive literature is available on portable water coolers and cans with the Sparkleen Liner. Sizes, models and price lists are fully covered in bulletins from Schlueter Mfg. Co., 4616 N. Broadway, St. Louis 7, Mo. Check the handy reply card.

Bulletin Helps Specify A.W.W.A., Gate Valves

547. Double disc gate valves in 2" to 60" sizes are fully described in a 16-page bulletin which gives details on valve parts, design, materials, application of the "O" Ring Seal, operation and operating devices, directions for ordering valves and parts, dimensions of all sizes, and descriptions of eleven different methods for end connections. Valves for horizontal operation, square bottom valves, many types of gearing and gear cases, and a complete listing of special controls available are included. Get Bulletin A from Rensselaer Valve Co., Troy, N. Y. by checking the reply card.

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STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.

Sidecrane-Backfiller-Tamper, A Versatile 3-Way Machine

125. A 3-way machine, the Cleveland 80W, that is a backfiller, sidecrane and tamper is described fully in a 12-page Bulletin, No. L-102, available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Design and construction features, photographs of the machine in operation and complete dimensions and specifications are covered. Check the reply card.

A Street Sweeper For Every Sweeping Need

158. A new catalog containing eight pages of illustrated information on street sweeping with the Mobil Sweeper, motor pickup type street sweeper, is just off the press. It is used on streets, highways, airports, parks, parking areas and other paved areas. For your copy write Mobil Sweeper Div. of the Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif., or check the reply card.

The Dilemma of Our Present Highway System

314. "Where Do We Go From Here?" is the title of a 16-page booklet produced by Caterpillar Tractor Company, Peoria, Illinois. Many highway problems are discussed in the interesting and informative booklet. Inadequate and obsolete highways, financing of free roads and toll roads, and whether to construct free roads or toll roads are a few of the topics. A section is devoted entirely to the story of modern highways from the planning stages through the construction stages to the finished roadways. Check the reply card for this booklet. Form 31398.

Eaton 2-Speed Axles For Your Trucks

264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Complete Information on Wain-Roy Back Hoe

459. Complete information on a self-contained back hoe that is designed to fit Payloader tractor-shovels and International crawler and wheel tractors is available from Wain-Roy Corp., Dept. C, Hubbardston, Mass. Included are specifications, types and many exclusive features. Check the reply card today.

Information on 5 Versatile Tractors For Municipal and County Work

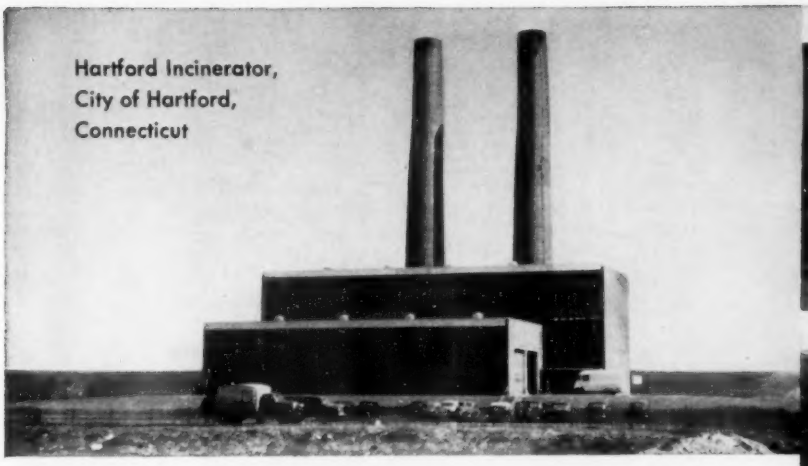
484. Tractors that find scores of highly efficient applications in construction, municipalities, utilities and related fields are described fully in a catalog just released by Massey-Harris-Ferguson, Inc., Industrial Div., Quality Ave., Racine, Wisc. Models, specifications, attachments and uses are covered.

3-Way Ditcher-Terracing Blades

488. Servis heavy duty and standard 3-way ditcher-terracing blades with scarifier teeth, grader wheels and end plates for conversion to a leveling scraper are described in bulletin available from Servis Equipment Co., 1000 Singleton Blvd., Dallas 21, Texas. Check the reply card for specifications, design and application.

A Modern Maintenance Tool For Compaction

523. Tampers that are the perfect answer to maintenance problems for street and highway departments contractors, utilities and airports are covered fully in bulletin just released by Jay Mfg. Co., 168 Hosack St., Columbus, Ohio. For information on how to put patches in to stay, tamp where a roller can't and work in all kinds of weather, check the reply card.



Hartford Incinerator,
City of Hartford,
Connecticut

Modern Hartford disposal plant uses FITCHBURG CHIPPER

Hartford's new municipal incinerator is used to dispose of more than 400,000 pounds of waste every day. The large picture above shows this efficient, attractive plant—one of the most modern in the nation.

An important part of Hartford's up-to-date disposal program is their portable Fitchburg Chipper, which cleans up disposal jobs the incinerator cannot handle, and goes out on location for road use.

Hartford had these problems:

- *Banana Stalk Disposal*
- *Brush Disposal on New Roads*
- *Christmas Tree Disposal*
- *Road Clearance from Storm Damage*

How a Fitchburg Chipper solves these problems:

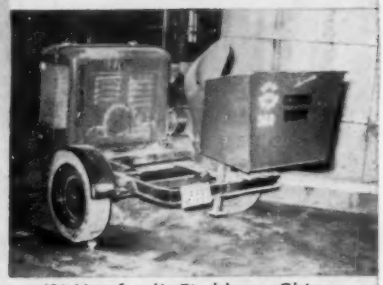
Joseph J. Coffey, Superintendent of the Hartford Incinerator, tells you in his own words how Hartford solves these problems: BANANA STALKS: "We chip 2 to 4 tons of banana stalks each week. These stalks will not burn regardless of heat in the furnaces, and we had to dump them until the Fitchburg Chipper went on duty." CHRISTMAS TREES: "During the post-Christmas season we receive many Christmas trees which we can now get rid of without the trouble of watching for burnt-down spike-like stubs which cause much trouble with the incinerator equipment."

BRUSH DISPOSAL: "Our Highway Division has used our Fitchburg Chipper to clean up the brush and branches along newly developed road areas. By chipping brush, the city saves in use of both manpower and trucking costs." ROAD CLEARANCE: "If we get hit again by hurricanes or bad wind storms, we now have an excellent piece of equipment that will enable us to readily open up the streets for emergency traffic by reducing the fallen branches to chips."

As to maintenance, Mr. Coffey says: "Our Fitchburg Chipper will pay for itself in a very short time. Maintenance, so far, is just keeping it supplied with gasoline and fully lubricated. It is easy to handle, easy to store, and very easy to use."

Get the facts! **Mail coupon for big, FREE, colorful booklet.** Specifications, operating data, explanation of exclusive Fitchburg Safety Spring, actual letters from users.

FITCHBURG ENGINEERING CORPORATION



(1) Hartford's Fitchburg Chipper

(2) Fitchburg Chipper in action

Read what leading Fitchburg users say

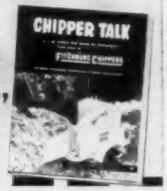
LINE CLEARANCE

The Shade Tree Service Company, *Webster Groves, Mo.:* "Our figures show that production has been increased by a good 25% with the use of the Fitchburg Chipper. One man can operate the chipper with ease. He alone can handle as much, and more, brush in the same length of time as could two men loading brush on a platform body."

POWER COMPANY

Rockland Light and Power Company, *Nyack, N. Y.:* "Our men have been particularly pleased with their Fitchburg Chippers. They are rugged and reliable and the convenience of flexible, yet instant brush disposal has the advantage of promoting good public relations and still gives us efficiency."

Yours FREE "CHIPPER TALK"



Fitchburg Engineering Corporation
Fitchburg, Mass., Dept.PW47

Send your new free booklet "Chipper Talk"

Name _____

_____
(Position or Company)

Address _____

City _____ State _____

To order these helpful booklets check the reply card opposite page 68.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the reply card for your copy.

Black Top Road Maintenance and Construction Equipment

286. A highly informative, 36-page catalog, covering the entire field of highway and road maintenance equipment has been released by Littleford Bros. Inc., East Pearl St., Cincinnati 2, Ohio. Units described and illustrated include distributors, supply tanks, sprayers, brooms, rollers, heater-planer, asphalt kettles and accessory tools. Check the handy reply card for your copy of this valuable catalog.

Better Drainage for Streets and Highways

358. Irving "Dryway" Draingrates provide maximum drainage openings for catch basin inlets, across-the-road drains and center-line drains. Light weight, strength, economy and corrosion resistance are a few of the many features offered. Full descriptive details on both riveted and pressure locked type are furnished in an illustrated bulletin by Irving Subway Grating Co., Inc., 50-53 27th St., Long Island City 1, N. Y. Check the reply card.

Better Traffic Signs By Using Plyglaze Overlaid Plywood

496. Plyglaze high density overlaid plywood requires no protective paint coating when used for traffic control signs. The plyglaze surface provides an ideal base for permanent weatherproof bonding, and it will not check, blister or deteriorate when marred by bullet holes. For further information write St. Paul & Tacoma Lumber Co., Dept. P.W., Tacoma 1, Wash., or check the reply card.

Prices and Specifications On Engineers Transits

563. General information on the operation of transits, causes of instrumental errors, cleaning and lubrication and adjustments are covered in available literature. For specifications, prices and ordering write Atlas Instrument Co., 705 Douglas St., Sioux City, Ia., or check the reply card.

Literature on 1957 Chevrolet Utility and Maintenance Trucks

579. Light and medium duty 1957 Chevrolet trucks are described fully in literature available from Chevrolet Div. of General Motors, Detroit 2, Mich. New features include modern versions of Thriftmaster and Jobmaster 6's and the short-stroke Trademaster V8's and the 283 cu. in. Taskmaster V8's. Also optional features are the Hydra-Matic and Powermatic transmissions. Check the reply card.

For Prompt Service Use The Reply Card

Better Mowing and Brush Removal

608. Fast, versatile tractor drawn Wood rotary mowers are available in a large selection of models to suit all types of municipal and highway department maintenance requirements. Be sure to investigate these units and discover how costs of roadside mowing, brush cutting, leaf mulching and park maintenance can be reduced with efficient equipment. Get full details by checking the reply card or from Wood Bros. Mfg. Co., Oregon, Ill

Hydrocrane Used As A Backhoe, Crane or Clamshell

606. When your work calls for lifting, digging and trenching all in the same day you need a machine that converts from crane to clamshell to hoe quickly and easily. Check the reply card or write Bucyrus Erie, South Milwaukee, Wisc. for information on the Hydrocrane.

Structural-Plate Bridge Flooring

515. A 12-page catalog on USF structural-plate bridge flooring includes a general description of the flooring, step-by-step installation photographs, drawings of engineering details, design data and specifications. Check the reply card or write United Steel Fabricators, Inc., Wooster, Ohio, for your copy.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 120 So. LaSalle St., Chicago 3, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

High Density Overlaid Plywood For Traffic Signs

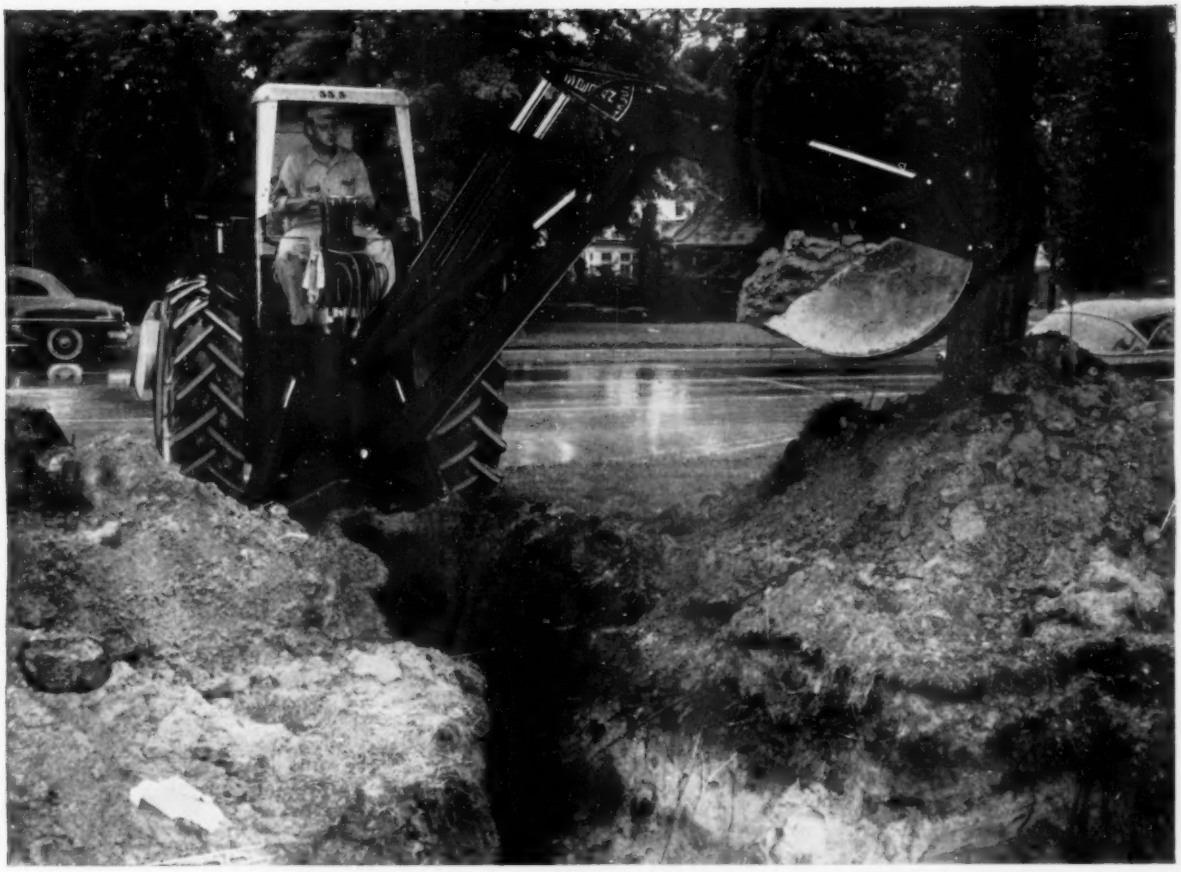
613. Overlay plywood prevents checking; or grain raise; has a pleasing appearance; is durable; and panels can be carried in stock in full sheets and cut to size as needed. For complete data and specifications on overlaid plywood for traffic signs check the reply card or write Douglas Fir Plywood Association, Dept. 140, Tacoma 2, Wash.

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Rotary Mowers For Roadside Maintenance

622. Rotary mowers that fit most makes of 4-wheel tractors are described in literature available from Danuser Machine Works Inc., Tulsa, Oklahoma. For complete information on these units for grass, weed and brush control check the reply card today.



City of Dearborn, Michigan, Saves Money With Sherman Digger-Loader

The City of Dearborn's Water Department has found its Sherman Major Digger-Loader combination to be one of the most versatile pieces of equipment it owns.

The Sherman unit is used almost continually for pipeline construction work, laying water lines, setting fire hydrants, and for repairing and maintaining water and service lines to homes.

Once the excavation is completed, the Loader takes over. Loading trucks with a fast cycling Sherman Loader, cleaning up around a job, backfilling, grading and levelling, stripping . . . all are performed quickly and economically with the same basic piece of equipment which was used to dig the hole *and* by the same operator.

As Mr. Molner, the operator, puts it, "We couldn't do the jobs we are doing with any other machine. We've got to have the power and strength the Sherman Major offers to dig as hard and as deep as we do. We also use the unit to load our machinery on and off the trucks, to lower pipes and hydrants into trenches and holes, etc."

Other cities, too, are finding out how this *economical* Digger-Loader combination can save them money. Call your local Ford Tractor dealer today or write for Bulletin No. 557.

See the Sherman
Power Digger soon
at your local
FORD TRACTOR DEALER

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Complete Information and Installation Data on Clay Pipe

225. A fully illustrated bulletin containing complete data on vitrified clay pipe with pre-assembled Tylox flexible couplings has just been released by Universal Sewer Pipe Corporation, 1500 Union Commerce Building, Cleveland 14, Ohio. Complete information on Universal's rubber, neoprene and polyvinyl chloride resin types of Tylox couplings is included. Check the reply card today.

Valuable Information on Underground Pumping Stations

246. The complete prefabricated underground pumping station is fully described in a bulletin just released by Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill. Construction features, corrosion control, electric controls, specifications, pumping equipment and installation are a few of the items covered. Check the reply card.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

"The Dorrco Monorake" For Water, Sewage and Industrial Waste Plants

355. Dorr-Oliver Inc. announces the availability of a new 12-page, two-color bulletin, "The Dorrco Monorake". This bulletin describes the design, types and sizes, operation and advantages of this mechanism. Write Dorr-Oliver Inc., Barry Place, Stamford, Conn., or check the reply card for sketches, line drawings and installation photographs of the unit.

Combat Unpleasant Odors At Municipal Sanitation Sites

404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 60 East 56th St., New York 17, N. Y. or check the reply card.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Down to Earth

Here's a "down to earth" fact. From base details to pole tops, Monotube street lighting poles are engineered to the highest standards of quality, appearance and performance. No compromise!

You are assured of satisfaction *and* economy both today *and* "tomorrow".

For catalogs or specific engineering data, write to The Union Metal Manufacturing Company, Canton 5, Ohio.

UNION METAL

Monotube Lighting Poles

To order these helpful booklets check the reply card opposite page 68.

Solids Pump Uses Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details get Bulletin P10-B6 by writing to Western Machinery Co., 650 Fifth St., San Francisco 7, Calif., or check the reply card.

We Clean Sewer and Water Pipes

487. American Pipe Cleaning Co. cleans sanitary sewers and water mains for municipalities by contract with the latest methods and equipment and by trained, experienced crews. Write American Pipe Cleaning Co., 1918 Nicollet Ave., Minneapolis, Minn., or check the reply card for information on this pipe cleaning company.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Bulletin On Locating Trouble in Pumps

533. A bulletin to help locate and correct common ailments of rotary, centrifugal and steam pumps has been released by Worthington Corp., Merchandising Sales Dept., Harrison, N. J. Pictures give a full description of pump troubles—from failure to deliver water to the loss of capacity after starting.

Amvit Mechanical Jointed Clay Pipe

298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide. Check the reply card.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

New Catalog on Flexible Compensation Fittings

453. This 12-page catalog, well illustrated both by photographs and drawings, highlights copper tubing. Illustrations taken from case the use of these fittings on steel piping and histories and featured throughout the catalog, will be of special interest to equipment designers and piping engineers. Get your copy from Dresser Mfg. Div., Bradford, Pa., or check the handy coupon.

Literature on Odor Control and Sewage Foaming

554. Literature is available from Fine Organics, Inc., 211 East 19th St., New York, N. Y., on "Cifon" that is used for odor control in connection with various sewage treatment processes and "Form-Wilt" that may be added to sewage for controlling foaming, particularly in aeration tanks. Check the reply card for your bulletins.

CONSTRUCTION EQUIPMENT AND MATERIALS

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

How to Get Better Concrete Construction

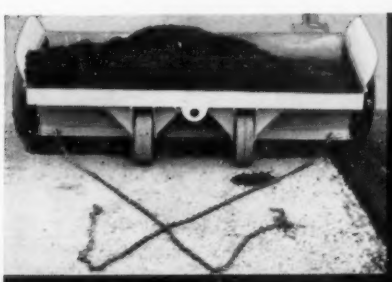
93. A report on the use of "Pozzolith" as a means of increasing the strength and durability and reducing the permeability of concrete structures, while reducing costs at the same time, is presented by Master Builders Co., Cleveland 3, Ohio. Check the reply card today.

Better Paving On Small Jobs

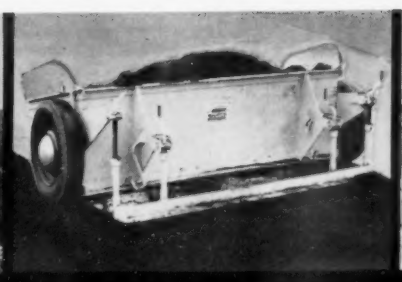
176. Blaw-Knox Company's small-job paving machine, the Adnun Jr. 8, is the subject of bulletin No. 2609. The Adnum Jr. is equipped with a 12-HP motor. Hopper capacity is approximately 2 tons. It will pave an 8-ft. strip. For full engineering details and on-the-job performance data, get this bulletin from Construction Equipment Div., Blaw-Knox Co., Mattoon, Illinois. **Check the reply card.**

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Neteo Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Neteo Div., Clarke Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.



Fastens on standard dump truck



Wheel adjusted to ride on top of last pass

Carried on dump truck gate

LITTLEFORD TRUE-LAY paver-spreader

produces compaction equal to 80% of heavier, more expensive pavers

Here's why only Littleford can make this statement:

1 60% more weight. True-Lay weighs 1600 lbs.; heaviest comparable unit weighs 1000 lbs.

2 Patented arrangement puts 75% of the weight of the True-Lay *and* material on the compaction screed.

Here's what this means to you:

1 more economical paving and spreading.

2 roll sooner. With True-Lay greater compaction, you get the roller on the asphalt faster . . . and less rolling is required.

3 labor saving. You need only a raker, shoveler and screed operator for the True-Lay. Compare this with the 7 or 8-man crew required for other units.

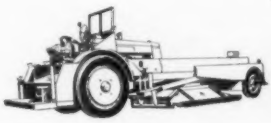
Here's where:

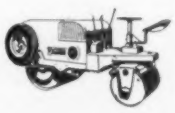
Only Littleford makes the True-Lay paver-spreader. For complete information, use the convenient coupon below and send for Bulletin 33, Littleford Bros., Inc., Dept. 229 A
452 E. Pearl St., Cincinnati 2, Ohio.

Lay a better mat

for less with True-Lay
New bulletin 33 tells how.

1882 - 1957 75 LITTLEFORD BROS. INC. CINCINNATI TOPS IN BLACK TOP





Gentlemen:
Please send me at once and without obligation, copy of new True-Lay bulletin 33.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

LITTLEFORD world's most complete line of completely engineered black top equipment

To order these helpful booklets check the reply card opposite page 68.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the reply card today.

Davis Back-Hoe and Davis Loader

312. Literature is available from Mid-Western Industries, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis back-hoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

High Capacity Continuous Mix Asphalt Plants

334. A 34-page, 3-color catalog describes all of the components of Barber-Greene's Model 848 continuous-mix asphalt plant. Check the reply card or write Barber Greene Co., Aurora, Ill., for information on the mixer, several varieties of dryers, dust collectors, elevators and bins.

Tracto-Loaders For Fast Material Handling and Excavating

600. Tracto-Loaders with capacities from ½ cu. yd. to 1⅛ cu. yd. are described fully, in a 2-color catalog available from Tractomotive Corp., Deerfield, Ill. General purpose material handling and excavating loading in confined areas are jobs performed by these machines. Check the reply card.

Paints For Bridges, Water Tanks & Other Metal Structures

624. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

Drafting Machines For Drafting and Designing Departments

393. The Vemco drafting machine combines all the working features of a T-square, protractor, and various scales and triangles. For illustrated bulletin on this piece of drafting equipment write V & E Mfg. Co., Dept. A-2, P. O. Box 950-M, Pasadena, Calif., or check the reply card.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Joint Materials and Sealers Described in Latest Literature

492. Fibre material, asphalt board, cold pour joint sealer, crack fillers and concrete curing compound are described fully in literature available from Presstite-Keystone Engr. Products Co., 3906 Chouteau Ave., St. Louis 10, Mo. Check the reply card for information on these paving and building products.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the reply card.

Complete Line of Road Rollers and Compaction Equipment

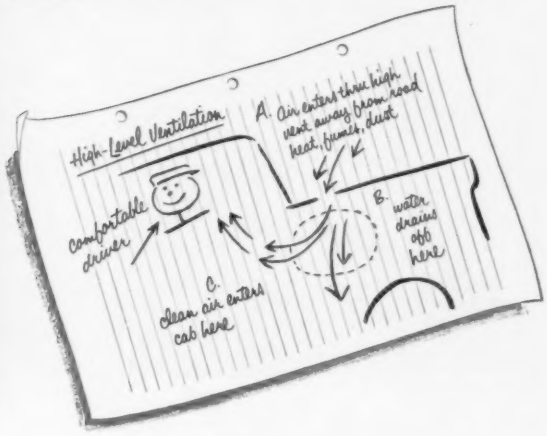
520. Buffalo-Springfield's complete line of road rollers and compaction equipment is described in a 12-page illustrated Bulletin No. S-73-157 just released by Buffalo-Springfield Roller Co., Division of Koehring Co., Springfield, Ohio. Check the reply card for on-the-job pictures, as well as construction details of the 2-axle tandems, 3-axle tandem, 3-wheel rollers and the K-45 Kompactor.

STREET LIGHTING AND TRAFFIC CONTROL

Latest Data on Prestressed Concrete Lighting Standards

265. Comprehensive data on prestressed concrete standards for street and highway lighting is contained in a 24-page catalog which contains complete engineering tables and descriptive information on design features, mounting arrangements, base type choices and specifications of Hy-Lite standards. Get helpful and easy-to-read Catalog No. 300 by writing to American Concrete Corp., 5092 No. Kimberly Ave., Chicago 30, Ill., or check the reply card.

in a Chevy cab, even the air is better!



...more evidence that Chevrolet Task·Force Trucks are engineered better and built better for bigger savings!

These cab features give you extra comfort and safety behind the wheel, extra savings on truck maintenance. And they're proof that the most modern trucks for your money are Chevrolets!

The drawing "doodled" above shows how Chevy's High-Level ventilation provides a *comfortable* interior . . . and the numbers in the big picture point out other advantages equally as good to have around you when you haul! They include:

1 *A roof that's specially built for safer, more comfortable hauling.* Sturdy all-steel construction adds to safety; roof's unique inner reinforcement insulates the overhead against heat.

2 *A gleaming, durable baked enamel outside finish.* Here's the reason your Chevy's exterior will resist wear better, look like new longer! This handsome finish is available in a wide variety of colors.

3 *A Nu-Flex seat that beats the bumps!* Deep-comfort coil springs, metered air shock damping and 3-way adjustment let you take it easy on tough jobs!

4 *A cab that's rustproofed to last!* Doors and similar surfaces are rustproofed on the inside as well as on the outside by immersion.

5 *Concealed Safety Steps for convenience.* Inside each cab door, they give you firmer footing, make entering or leaving the cab easier and safer.

6 *An undercoated floor, cowl side panels and fender flanges.* Virtually all exposed surfaces on the underside of the cab are protected by an anti-rust coating.

7 *A non-glare instrument panel to make driving safer!* The textured finish on upper portion of Chevy's instrument panel reduces blinding sun reflections, minimizes eyestrain.

8 *A reliable 2-speed electric windshield wiper* on each side.* Powered by electricity, their action remains *constant* under all conditions.

Such advantages as these (we've shown only a few) combine to make *everything* better in a 1957 Chevrolet truck! You'll see for yourself when you visit your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Standard in Series 5-6-7-8-9-10000 models.*

. . . biggest sellers because they're the biggest savers! CHEVROLET

CHEVROLET TASK·FORCE 57 TRUCKS

To order these helpful booklets check the reply card opposite page 68.

Get Full Data On the Radar Speed Meter

22. Accurate readings of vehicle speeds, with direct indications in miles per hour and a graphic recorder for permanent record are available by use of the Electro-Matic Radar speed meter, a product of Automatic Signal Division, Eastern Industries Inc., Norwalk, Conn. For full data on this device, just check the reply card.

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

All-Aluminum Supports For Traffic Control Programs

64. Design and specifications of all-aluminum supports for traffic control signals and signs are covered in a 20-page catalog just released by Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. Type of supports described are as follows: Trombone type standards for horizontal signal over roadway; mast-arm type standards for vertical signals; truss type span for lane traffic signals; structural truss type span for horizontal signs over roadway; pedestals and sign supports. Check the reply card for your copy.

•

WEED AND DUST CONTROL

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15, Texas.

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

Calcium Chloride for Roads

98. A 24-page booklet "The Why of Wyandotte Calcium Chloride for Roads" is available from Wyandotte Chemicals Corporation, Michigan Alkali Division, Wyandotte, Michigan. The booklet explains in copy and pictures why calcium chloride has become so widely adopted for the treatment of unpaved road surfaces. Also, such topics as elimination of gravel loss and reduced blading are covered. Check reply card for your copy.

What You Should Know About Chemical Weed Control

203. General information on how and when to use Telvar, the chemical weed killer, is described in literature available from E. I. DuPont De Nemours & Co., Inc., Wilmington 98, Del. Application rate, type of weeds killed, type of equipment used for application are some of the sections covered. Check the reply card.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

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REFUSE COLLECTION AND DISPOSAL

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included. Check the reply card today.

For Prompt Service Use The Reply Card

New M-B Packer Body Designed for Maximum Payload

339. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16, 20, 24 cu. yd. capacities. Get all the facts from M-B Corp., New Holstein, Wis.

Complete Package Dravo Incinerator Plant

584. The Dravo incinerator includes receiving pits, automatic refuse handling system, automatic combustion controls, traveling grate stoker and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

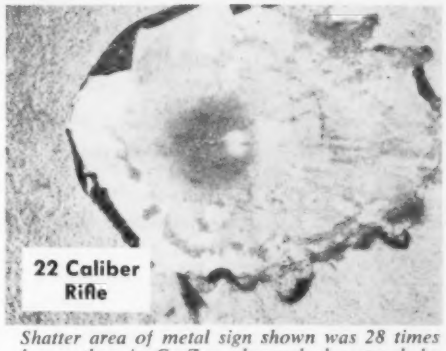
The bullet holes in CreZon overlaid plywood are scarcely visible, tend to seal themselves.

A SIGN THAT REFUSES TO SAY "I'M DEAD"

● To frustrate the "sign hunters", more and more highway sign users are adopting CreZon overlaid plywood signs. These new-type signs don't resound, don't show gaping holes. And the bullet holes remain small, even tend to fill in, thus sealing themselves.

Weather tests prove that CreZon plywood signs have an actual life expectancy of up to 15 years. The material is strong and rigid; resists bending or tearing loose from pole. There's neither checking nor blistering from heat or freezes. And water won't seep in behind its weather-proof surface.

CreZon plywood is easy to work, too. Its velvet-smooth tooth takes paint extremely well, assures greater visibility, higher gloss. You cut costs in many ways with this ideal sign material.



Shatter area of metal sign shown was 28 times larger than in CreZon plywood also struck by a 22 calibre bullet.

CreZon plywood is available through these plywood manufacturers and their distributors. Consult your Yellow Pages for company nearest you or write Dept. CR, Crown Zellerbach, 343 Sansome St., San Francisco 19, California.

Diamond Lumber Company
Tillamook, Oregon

Georgia Pacific Plywood Co.
Olympia, Washington

Edward Hines Lumber Co.
Chicago 2, Illinois

Mount Baker Plywood, Inc.
Bellingham, Washington

Roseburg Lumber Company
Roseburg, Oregon

St. Paul & Tacoma Lumber Co.
Tacoma, Washington

United States Plywood Corp.
New York 36, New York

Walton Plywood Company
Everett, Washington

Also available in Canada through:

Canadian Western Lumber Co.
New Westminster, B. C.

MacMillan & Bloedel, Ltd.
Vancouver 1, B. C.

Western Plywood Co., Ltd.
Vancouver 15, B. C.

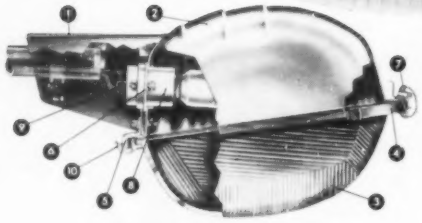
The permanent protective overlay for plywood.

CreZon®

Another quality product by

CROWN ZELLERBACH
SAN FRANCISCO 19, CALIFORNIA

New Westinghouse



Check EVERY ONE of these Incomparable Westinghouse Features

1. Cast aluminum slip-fitter for 1¼" pipe. **2.** Heavy, drawn-aluminum reflector, with Alzak process finish. **3.** Westinghouse exclusive Holophane refractor. **4.** Die-cast aluminum globe ring. **5.** 100% wool non-moisture-absorbent gasket. **6.** Moisture-dirt- and bug-proof gasket seal. **7.** Stainless-steel pressure latch. **8.** Porcelain-clad socket. **9.** Wiring terminals easily accessible. **10.** Hinged globe gives easy maintenance! **AND**—A SIMPLE MOVE OF SOCKET FLANGE AND GASKET to inside of reflector ALTERS TYPE OF LIGHT DISTRIBUTION!

GIVES IDEAL TYPE II LIGHT DISTRIBUTION

SIMPLE INSTALLATION MOVE GIVES TYPE I DISTRIBUTION

Local Residential Streets, Secondary Streets, Suburban Thoroughfares

. . . where people live . . .

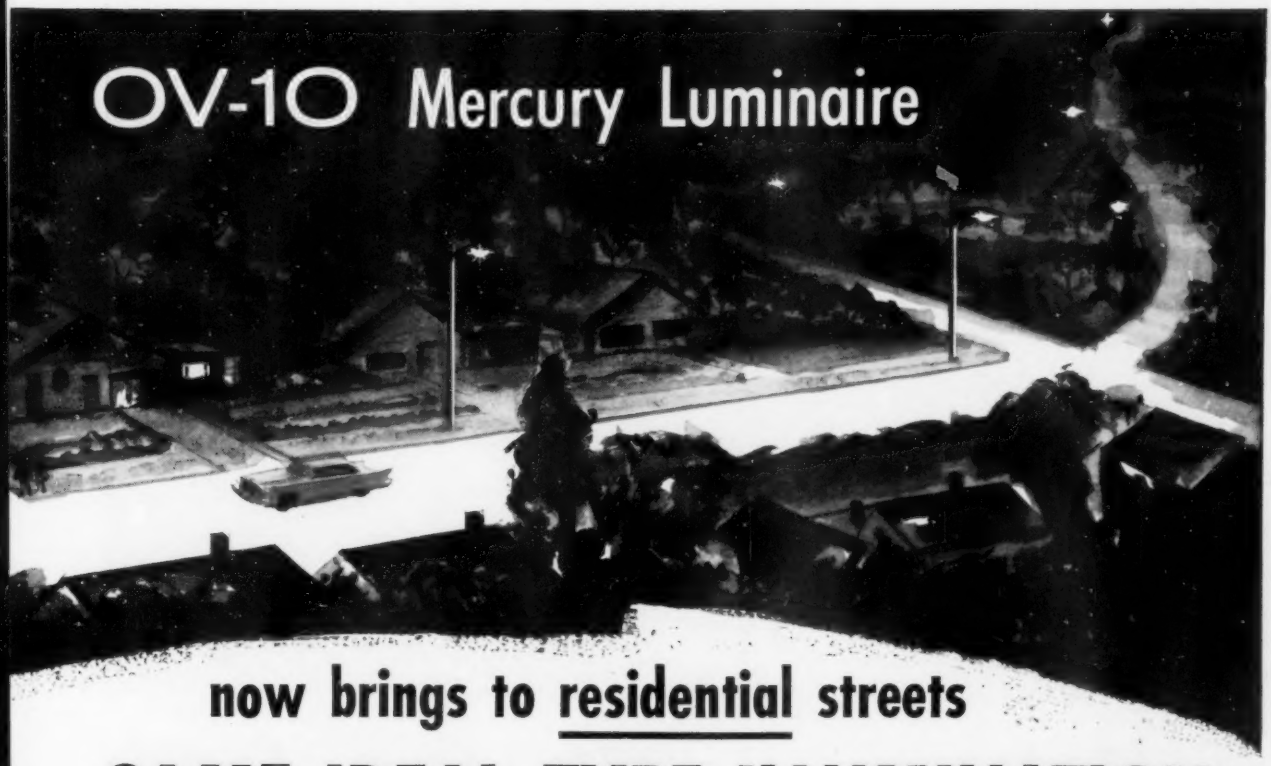
Now get 2 to 3 times more light! . . . at no appreciable increase in cost!

There is now a mercury luminaire that provides new levels of lighting, pronounced safe and comfortable for residential streets, at almost startling low cost!

This luminaire, named the Westinghouse OV-10, simply permits additional specific applications of remarkably efficient, new-type, mercury lamps—which commonly are now known to supply business thoroughfares with *200% to 300% more light!—at only nominal increase in cost!* —over that for old-style street lighting!

In addition, this new OV-10 luminaire has been engineered identically to match, *and to complement,* the improved Westinghouse series of OV-20, OV-35 and OV-60 luminaires.

Moreover, this is the famous OV luminaire group that solves virtually every roadway lighting problem. These are the OV luminaires you've heard about—delivering today, throughout countless thousands of applications, *2 to 3 times more light!*



now brings to residential streets

SAME IDEAL-TYPE ILLUMINATION DEMANDED BY MERCHANTS!

Has same sealed-in, advanced, optical system; same ease, speed, economy of installation and maintenance

See the entire list of special design refinements, exclusive Westinghouse features, of this new, OV-10 luminaire, shown in cutaway illustration at left, including: heavy-gauge aluminum housing and cast aluminum slip-fitter—highly efficient Alzak reflectors—and precision designed refractors, delivering maximum lumens-per-watt to the roadway!

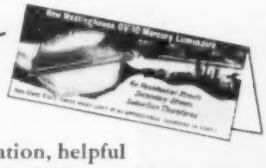
Westinghouse leads all others in the design and development of mercury illumination for all roadway lighting applications

Now this new, OV-10 luminaire enables your Westinghouse representative to *assure* you of *Residential Street Lighting* with *ideal illumination* for *each particular purpose,* at *lowest costs practical today!*

The OV-10 utilizes the following mercury lamps:

L-H4	100 Watts	3,300 Lumens
A-H22	175 Watts	6,800 Lumens
C-H5	250 Watts	11,000 Lumens

Accept



complete information, helpful application data, in folder on this new, advanced, Type OV-10 luminaire. Get folder from your Westinghouse sales representative. Or write Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio. J-04409

YOU CAN BE SURE... IF IT'S Westinghouse

Gradall loosens, lifts and loads curb sections intact, grasping curb firmly against boom with its hydraulic bucket "wrist" action.

Gradall removes 2400 feet of curb and sidewalk per day!

First, Gradall smoothly breaks out and loads large 4 to 5-foot sections of asphalt sidewalk. Then it efficiently digs out behind the curbing prior to its removal. This machine can easily work under low wires, trees or other obstructions.

Triples previous rate!

That's the average turned in on this 120,000-foot San Diego job by the R. E. Hazard Contracting Company. By the two previous methods used, 800 to 1,000 feet a day was considered very good.

Gradall first removed large sections of sidewalk, then cut out behind the curb, then grasped and loaded out curb sections intact. A cost-saving bonus resulted from the fact that the Gradall method eliminated costly pavement damage during curb removal.

Supt. Wayne W. Wallace states: "There is no way at all you can take it out cheaper than with a Gradall."

Since delivery in December, 1954, Hazard's Gradall has averaged over 200 on-the-job hours every month! They keep this multi-purpose machine busy on a wide variety of jobs—often on work no other machine could touch—jobs where Gradall's power and arm-action accuracy really pay off.

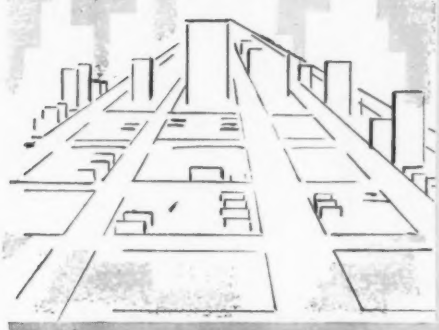
Find out exactly how a Gradall can cut costs for you. Arrange for a field demonstration now with your nearest Gradall Distributor.

Gradall®
DIVISION OF WARNER & SWASEY Cleveland
® Reg. U.S. Pat. Off.
"PRECISION MACHINERY SINCE 1880"

Distributors in over 75 principal cities in the United States and Canada

YOU CAN DO IT BETTER, FASTER, FOR LESS WITH A GRADALL

as a city grows...



so must its water system

Rapid expansion in population and industry overtaxes many municipal water systems. Arlington, Texas, a fast growing community located between Fort Worth and Dallas, meets increased water demands with Horton® elevated tanks . . . to provide a dependable gravity pressure water supply that will increase minimum pressures, reduce pressure variations and lower pumping costs.

A Horton elevated tank, built in capacities to 3,000,000 gals., can help your city overcome municipal growing pains too. Write our nearest office for complete information.

Above right: 1,000,000-gal. Horton radial-cone bottom elevated tank built for Arlington, Texas. It was pickled and painted before shipment.

Above: 300,000-gal. Horton ellipsoidal-bottom elevated tank built for Arlington, Texas, in 1951. It was pickled and painted before shipment.

Chicago Bridge & Iron Company

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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

MATCH THE NEEDS OF YOUR SANITARY LANDFILL JOB

from the complete Allis-Chalmers Tractor Shovel *line*

There's a size of Allis-Chalmers tractor shovel to fit every landfill need. Each Allis-Chalmers tractor shovel offers big capacity, mobility and wide-range versatility—ranging from 1½ to 4-yd bucket capacity. Each handles the complete landfill cycle—from start to finish—excavates, spreads, compacts, covers. Choose the one you need from the handy chart below.

A variety of quick-change attachments such as light materials bucket, rock bucket, bulldozer blade or ripper, makes your landfill unit useful on other municipal operations. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

The following chart is an estimate of equipment requirements:

Tractors Needed	POPULATION (1,000's) 2.5*	5*	10*	15	20	30	40	50	75	100
HD-6 with 1½-cu yd shovel	1	1	1	1	1	1	1**			
HD-11 with 2¼-cu yd shovel							1	1	1	2
HD-16 with 3-cu yd shovel	For Cities over 100,000 Population									
HD-21 with 4-cu yd shovel										

*Three or more smaller communities can be serviced by one HD-6G.

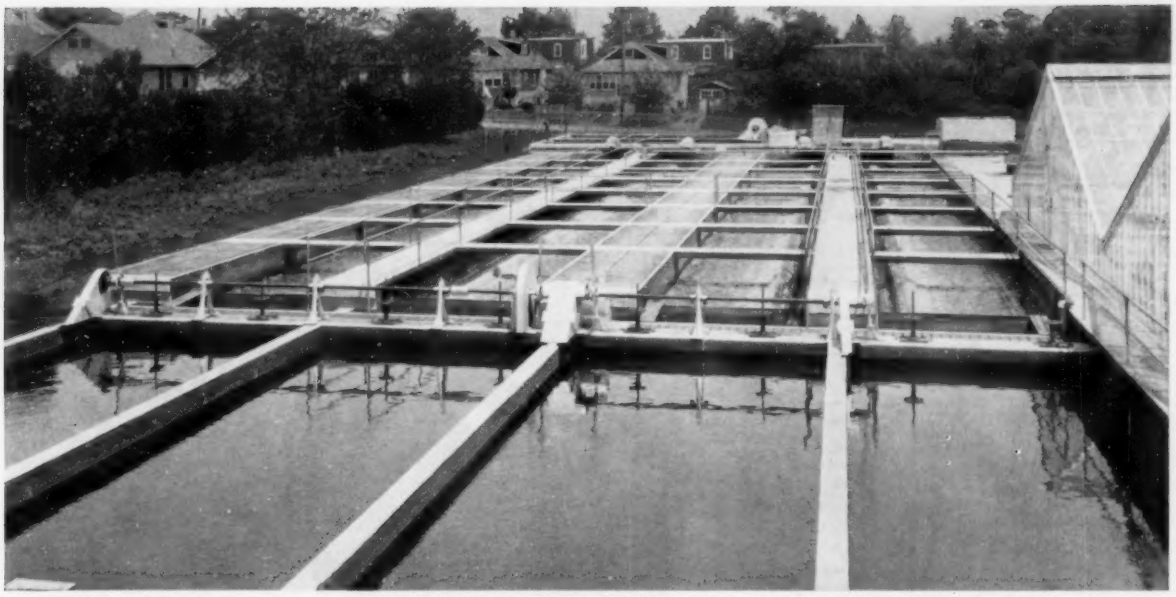
**Where towns or cities have none or very light industry and no ashes due to use of natural gas or oil for heating.

Model	HP	Weight, lb	Capacity yd
HD-6G	68.5 belt	19,600	1½
HD-11G	111 net	32,000	2¼
HD-16G	150 net*	47,800	3
HD-21G	204 net*	66,500	4

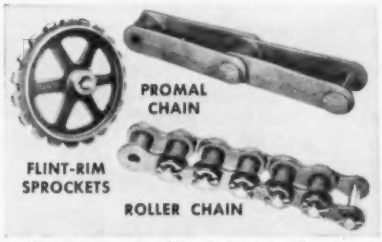
*Efficient torque converter drive

ALLIS-CHALMERS

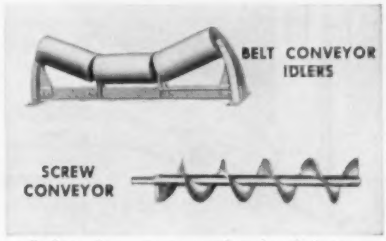
Engineering in Action



FOR 15 YEARS, Link-Belt chain on final tank Straightline Collectors at this activated sludge plant rendered dependable service without replacement, operating 24 hours a day. At other plants, Straightline Collectors have been in operation for a quarter century without replacements. Clearness of effluent may be judged by reflection of drive machinery in final tanks in foreground.



Precision steel roller chain transmits power positively at high or low speeds. Superstrong *Promal chains* and *Flint-Rim sprockets* were developed by Link-Belt.



Industry's most comprehensive *belt-conveyor idler* line features long-lived alignment, effective seals. Smooth, strong helicoid or sectional flights cut *screw conveyor* wear.

Choose from the broadest line of precision *self-aligning ball and roller bearings*, plus water-lubricated *Peak-Cap bearings* that won't accumulate sludge.

To the man who thinks of tomorrow

when specifying today's sanitary engineering requirements

Performance records support the LINK-BELT story

IN supplying your needs in municipal sewage and water treatment or industrial waste treatment, Link-Belt offers three vital "extras" you won't find written into specifications or quotations. The first—durability—is proved in exceptional service records like the plant above. Second is the extensive Link-Belt equipment line—screens, collectors, mixers, conveying and power transmission products—your assurance of impartial recommendations directly determined by your requirements. Third: prompt service, available from 40 Link-Belt district offices.

Your contractor may welcome the information that Link-Belt can supply complete erection service . . . of great convenience to him because of the specialized character of erection work necessary to achieve a well-fitted, complete installation without trouble or delay. Major cost savings, too, result from using Link-Belt's specialized erection crews who can travel anywhere to install Link-Belt water, sewage or waste treatment equipment.

Call your local Link-Belt office for consultation with a sanitary engineering specialist. He will gladly work with your own chemists and consultants.

14,543

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

ROOT-PROOF JOINTS

ORANGEBURG® *Root-Proof* PIPE AND FITTINGS

Independent investigation of Orangeburg Pipe sewer lines, in service up to 50 years, shows that its Taperweld Joints® remain tight . . . against leakage, infiltration, and root penetration.

Orangeburg's record in actual use has earned its recognition as a standard house sewer pipe by leading approving authorities from coast to coast.

OVER 250,000,000 FEET IN SERVICE!

Orangeburg Pipe delivers dependable service because it is strong and resilient . . . withstands temperature changes and traffic tensions . . . resists acids and alkalies in ground waters and sewage wastes. Lines 50 years old, operating like new today, prove its durability.

Orangeburg is easy to install. Lightweight 8-foot lengths handle fast. Taperweld Joints seal root-proof without cement or compounds.

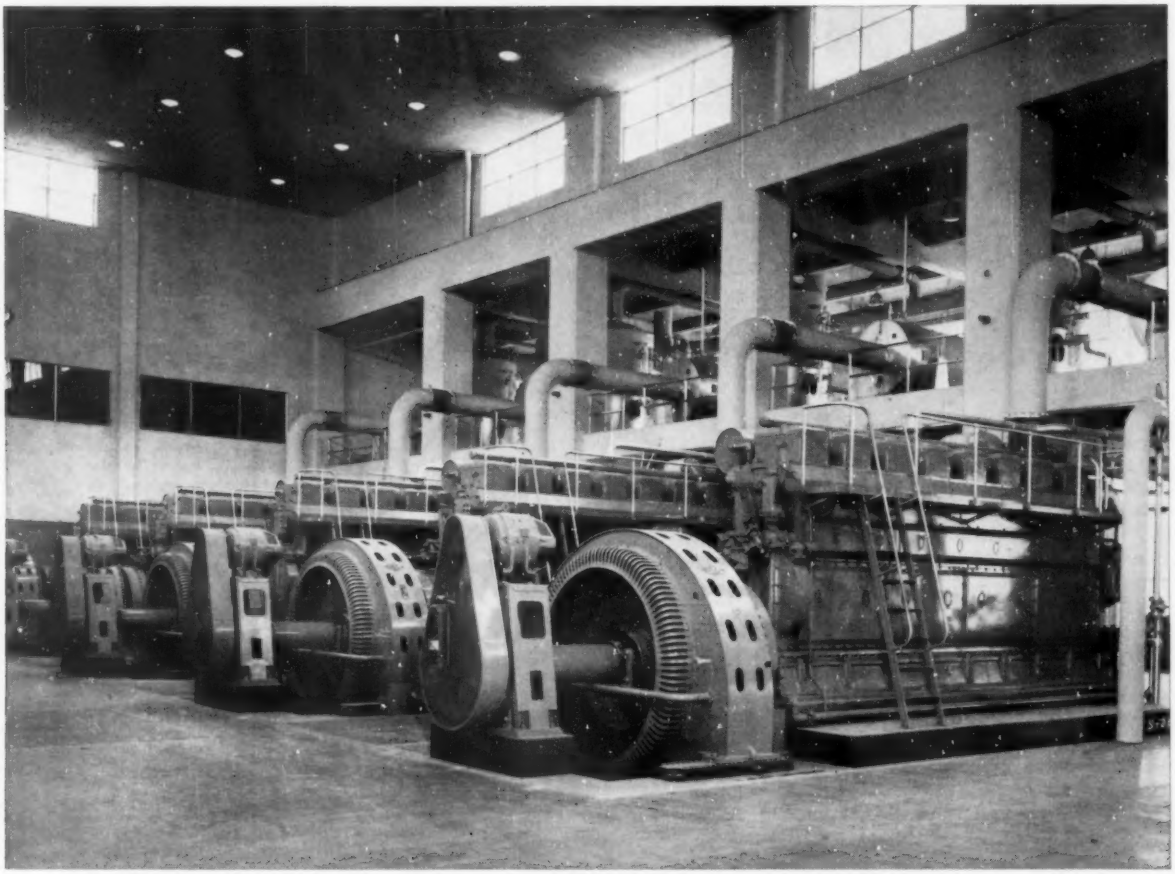
Orangeburg Root-Proof Pipe is for sewer lines from house to street main or septic tank; for downspout run-off lines; storm drains; other non-pressure underground outside lines. Orangeburg also comes *Perforated* for foundation drains, septic tank disposal fields . . . draining wet spots.

For summary of "Report On Investigation of Orangeburg Pipe For Sewers" by a prominent sanitary engineer write Dept. PW-47.

ORANGEBURG MANUFACTURING CO., INC.
ORANGEBURG, N. Y. NEWARK, CALIF.

ORANGEBURG ROOT-PROOF FITTINGS

"One of the most outstanding operational records in sewage treatment and engine operation" reports Diesel Progress about the Hyperion Activated Sludge Plant of the City of Los Angeles.



10 Worthington engines chalk up 293,899 hours and not one ring, liner, or bearing wore out!

ENGINE	OPERATING HOURS
No. 1	28,928
No. 2	31,163
No. 3	26,926
No. 4	30,422
No. 5	25,648
No. 6	34,472
No. 7	38,367
No. 8	33,785
No. 9	33,753
No. 10*	10,435

*Installed Oct., 1954

In six years of operation, the nine original Worthington engines averaged over 31,000 hours each.

Operating on methane produced in Hyperion's digestion facility, the Worthington engines are turbocharged dual-fuel units rated at 1688 hp each. In six years the ten engines have run 293,899 hours without wearing out a piston ring, cylinder liner, or bearing.

No. 7 Good for 100,000 Hours

Engine No. 7, first on the line, is typical. This engine has 38,367 hours on its original rings. After a routine overhaul, Hyperion engineers predicted a life of 100,000 hours —equivalent to 11 years of continuous operation—per set of rings. They expect double this life for the cylinder liners.

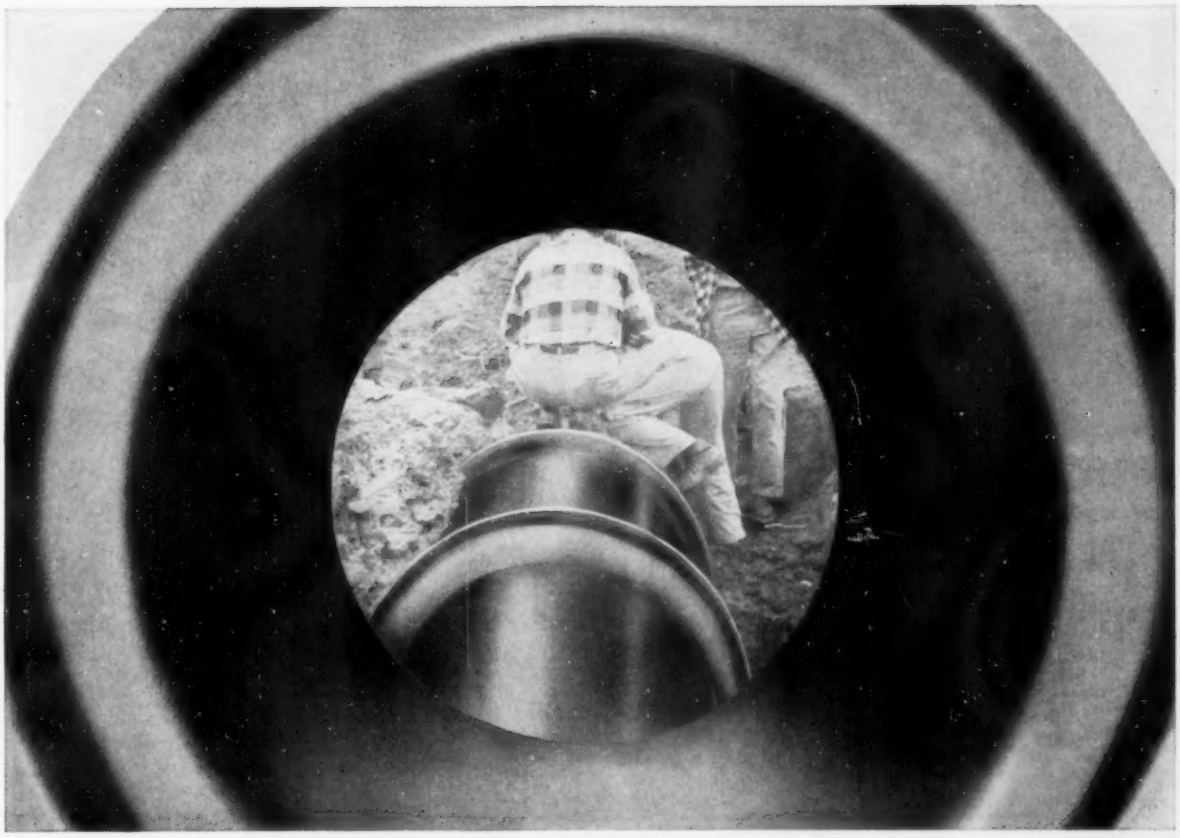
Good Operation

Of course, the finest piece of equipment would not give such an outstanding record without careful attention to such items as lubrication, clean fuel, temperature control, etc. Good operation is the watchword at Hyperion and annual overhauls, including checking of all operating parts, back up the high quality of the Worthington equipment.

Full Report Available

If you would like a reprint of "Hyperion's Six Years of Operation," an interesting article about the plant and its many maintenance innovations, please write to Section W63, Worthington Corporation, Harrison, N. J. Ask for Bulletin RP-928. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont. W.6.3

WORTHINGTON



Greenville, S.C. Builds for 1990 with CLAY PIPE

The new sewerage program now underway in Greenville looks far into the future of this fast-expanding area. Existing main and outfall sewers are being paralleled by larger ones designed to serve the community until 1990, or until the present 130,000 population has grown to 233,000. Greenville is following the pattern of hundreds of other cities which are building for the future by specifying the *guaranteed* pipe—Vitrified Clay. The total project will cost $3,500,000.

"Because of the character of the wastes handled and expected to be handled by the sewers," reports Superintendent E. D. Fry of the Greater Greenville Sewer District Commission, "it is the policy of the Commission to use Vitrified Clay Pipe wherever possible and to require it to be used by the subdivisions of the sewer district." Clay Pipe is the *only* pipe that *never wears out*.

Consulting Engineers—**Wideman and Singleton**
Contractors—**A. H. Guion & Co., Peden Construction Co., Glenn Construction Co.**
Greater Greenville Sewer District Commission—**E. D. Fry, Supt.**

THE PUBLIC *KNOWS* CLAY PIPE IS BEST

Vitrified CLAY PIPE NEVER WEARS OUT! PIPE

NATIONAL CLAY PIPE MANUFACTURERS, INC.
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C-857-2

BIBLIOGRAPHY ON COMMUNITY FACILITIES

This complete and valuable bibliography lists a large number of articles that have appeared during the past few years treating of the problems of urban growth and the facilities connected with such growth, as governmental relations, future planning, financing, water distribution, sewerage, highways, schools, zoning and subdivision control. There are also references to legal aspects. There are 140 mimeographed pages. Compilation was by the National Housing Center Library of the National Association of Home Builders. A limited number of copies are available free. For individual copies or information, write National Housing Center Library, 1625 "L" St., NW, Washington 6, D. C.

75TH ANNIVERSARY OF PHOENIX, ARIZONA

A very good report commemorating the 75th Anniversary of the incorporation of the City of Phoenix is available. This report has a threefold purpose: (1) to picture Phoenix and the municipal services provided during its early formative years, (2) to contrast this humble beginning with the services now being provided by your City, and (3) to outline briefly plans for the Greater Phoenix of the future. Copies are available from Mayor Jack Williams, City Hall, Phoenix, Arizona.

ENGINEERING STRUCTURAL FAILURES

The author of this book has set out to provide a useful survey of both the causes and the results of failures in a variety of examples over a century of engineering, including earthworks, dams, harbor works, buildings, bridges and tunnels. The book emphasizes the importance of scale-model and full-scale research on structural problems, and examples of sound design are quoted. The author is Rolt Hammond and the publishers are Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. Price per copy in $12.

Hoisington, Kansas, Water Works

TRIMS OPERATING COSTS WITH AUTOMATION

with Foxboro

TELETAX Telemetering

as first step

Foxboro Panel for TELETAX Control of isolated booster pumps is located at main treatment plant of Hoisington, Kansas Water Works. TELETAX Receiver (left) indicates and records storage tank level. Pressure Recorder (right) indicates and records clear-water level. Push buttons and acknowledgement lights are below instruments. *Consulting Engineers: Wilson & Co., Salina, Kansas.*

When you're operating booster pump installations out in the middle of nowhere, transportation costs for personnel can run mighty high. Hoisington, Kansas had that problem until they installed Foxboro TELETAX Telemetering. Now with TELETAX making the 14-mile round trip *electrically*, operators can stay at the main plant and turn the pumps on and off by push button. With TELETAX automatically tied in with other plant control functions, the resulting integrated system is expected to save almost $4000 yearly in operating expenses!

Here's what this modern control system will do — automatically: clearly indicate, record, and regulate level of clearwells and storage tanks; prevent pump operation whenever clearwells are dry or full; alert the operators immediately if line breaks; provide safe, unattended operation round-the-clock during peak demand periods.

Investigate the money-saving, efficiency-boosting advantages of Foxboro Automatic Control for *your* operation. Write for information. **The Foxboro Company, 264 Norfolk St., Foxboro, Mass., U.S.A.**

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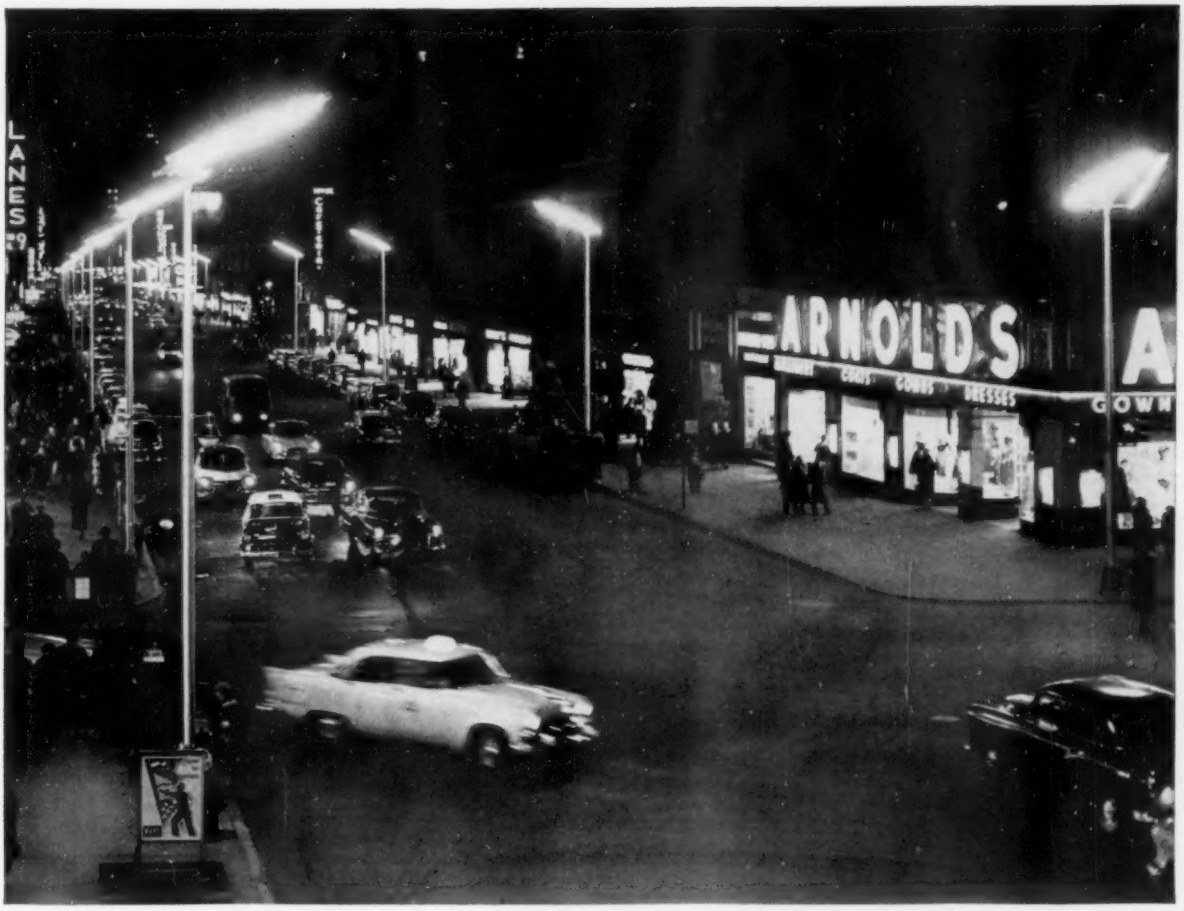

New York City's "14th Street Association" proves modern whiteway lighting pays big dividends

With the use of P & K aluminum standards and LUXaire® Fluorescent Luminaires, the average light level on 14th Street, a major downtown shopping center, has been increased from 0.4 to better than 2 foot candles. The P & K LUXaire® units, specially designed in wedge shape, are mounted at 30-foot height on staggered 70-foot spacings.

The choice of P & K equipment, combining high strength with light weight, permitted the use of existing electrical vaults with a minimum of excavation and foundation work. Installation was quick, easy, and low in cost. Negligible maintenance requirements, a feature of all P & K products, will serve to keep the *real* cost of lighting equipment on 14th Street surprisingly low.

Comments from the 14TH STREET ASSOCIATION, who paid for the new lighting: "New White way has accomplished its purpose . . . business improvement . . enhanced shopping area . . . safer for shoppers and vehicular traffic. . . ."

WRITE FOR A COPY OF THE P & K LUXaire® Catalog . . . and use the P & K planning and advisory services without obligation.

P&K PFAFF & KENDALL
84 FOUNDRY ST., NEWARK 5, N. J.

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. . . Researching a project or problem?

Take advantage of recent literature describing proven methods, materials, services and equipment, especially written to help you find the quick, efficient answers to almost all public works questions.

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Atlantic City, N. J., May 12-17

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American Public Works Ass'n
Augusta, Georgia, May 30-31

New Jersey Section, AWWA
Summit, New Jersey, June 6

Pennsylvania Section, AWWA
Bedford Springs, Pa., June 12-14

International Municipal Signal Ass'n, Southwest Section
Amarillo, Texas, June 13-15

New York Sewage and Industrial Wastes Ass'n
Lake Placid, N. Y., June 17-18

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Dayton, Ohio, June 19-21

Iowa Sewage and Industrial Wastes Ass'n
Des Moines, Iowa, June 19-21

Central States Sewage and Industrial Wastes Ass'n
Chicago, Ill., June 26-28

Pennsylvania Sewage and Industrial Wastes Ass'n
University Park, Pa., Aug. 28-30

Wisconsin Section, AWWA
Milwaukee, Wisconsin, Sept. 4-6

New York Section, AWWA
Lake Placid, N. Y., Sept. 11-13

South Dakota Sewage and Industrial Wastes Ass'n
Sioux Falls, S. D., Sept. 11-13

New England Water Works Ass'n
Boston, Mass., Sept. 15-18

International Municipal Signal Ass'n
Miami Beach, Fla., Sept. 16-19

Ohio Section, AWWA
Cincinnati, Ohio, Sept. 18-20

Public Works Congress and Equipment Show
Philadelphia, Pa., Sept. 22-25

Kentucky-Tennessee Sewage and Industrial Wastes Ass'n
Louisville, Ky., Sept. 23-25

Michigan Section, AWWA
Detroit, Michigan, Sept. 25-27

Okla. Sewage and Industrial Wastes Ass'n
Stillwater, Okla., Sept. 25-26

North Central Section, AWWA
Fargo, N. D., Sept. 25-27

Federation of Sewage and Industrial Wastes Ass'n
Boston, Mass., Oct. 7-10

American Public Health Ass'n
Cleveland, Ohio, Nov. 11-15

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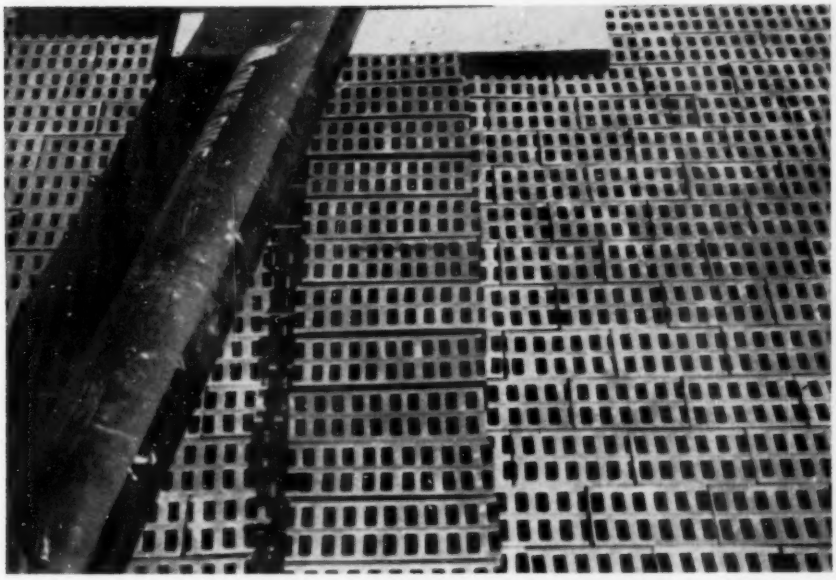


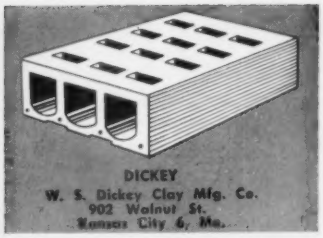
Orient (Ohio) State Institute trickling filter with TFFI Specification underdrain blocks. Engineers, Uhlmann & Associates; Contractor, E. P. Coady & Co., both Columbus, O.

Greatest Improvement in Trickling Filter Design...

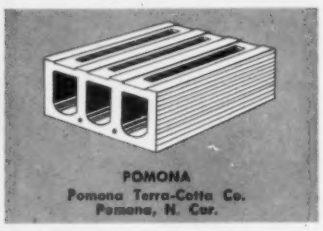
TFFI vitrified clay underdrain blocks are the greatest improvement yet introduced into trickling filter design. All consulting engineers should specify them. They provide maximum drainage and ventilation capacity. They are strong, durable, corrosion-resistant and easy to handle or lay.

Other Important Advantages

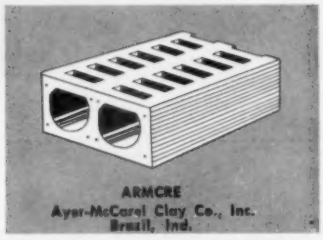
Other important reasons for choosing trickling filters with TFFI blocks in *any* plant are: Simple, easy operation; long life — longer than the bonds issued to pay for plant; overload is no problem — take temporary and shock loads in stride. Also, good results: top-notch effluent, day in and day out; ease of expansion, trickling filters, properly designed, are easy to expand to meet future increases in population or loading. And adaptability to handle industrial wastes and domestic sewage, separately or combined.



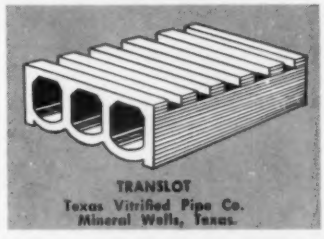
DICKEY
W. S. Dickey Clay Mfg. Co.
902 Walnut St.
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, N. Car.



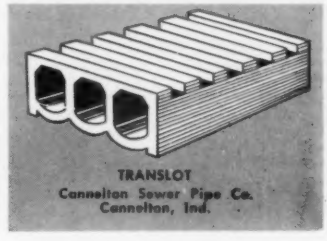
ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas.

BOSCO
Bowerston Shale Co.
Bowerston, Ohio

NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



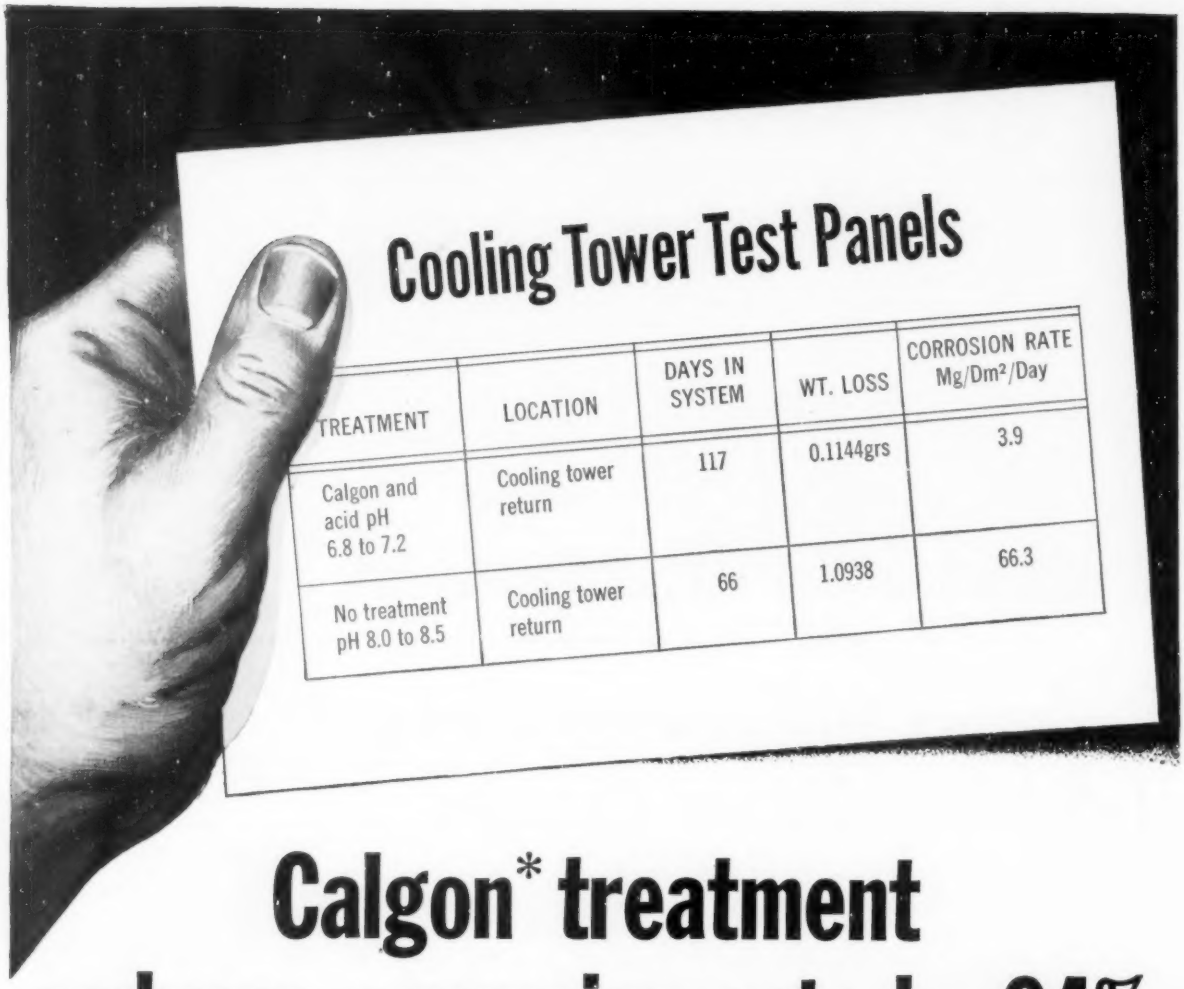
TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

TFFI

Symbol of good treatment

TRICKLING FILTER FLOOR INSTITUTE

Designing engineers may address any manufacturer member listed in panel at right for HANDBOOK OF TRICKLING FILTER DESIGN—free.



Calgon* treatment reduces corrosion rate by 94%

. . . system cleaned

The chart shows the effect of Calgon treatment in this 20,000 gallon per minute recirculating cooling system. The corrosion rate as indicated by steel test strips was reduced from 66.3 Mg/Dm²/day to 3.9 Mg/Dm²/day. This reduction of 94% was obtained despite the fact that the test unit consisted of coupled steel and copper plates, creating a galvanic cell which would normally increase the corrosion rate severely. The copper strips showed no corrosion.

The low pH-Calgon treatment did more than achieve an extremely low corrosion rate. It also removed old corrosion products from the system, stepping up system efficiency, and making the treatment itself more effective.

These results definitely indicate that for the less complicated corrosion problems no supplemental inhibitor of any kind is required in conjunction with the use of Calgon brand sodium hexametaphosphate. However, the Calgon Company has developed specific answers to water damage problems of all kinds. If necessary, iron and steel surfaces can be given fast and more complete protection with Calgon composition TG, remarkable for its accelerated film forming ability. Copper or copper alloy corrosion can be prevented with Coraid, which is effective at both high and low pH values. Protection is provided for the entire system, from cooling towers on through.

Write or phone for information on how Calgon Engineering Service can help you.

*Calgon is registered trademark.

CALGON COMPANY

A DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES

READY

For Anything

That's the big pitch of the new Homelite Diaphragm Pump. It's ready for anything . . . ready for everything . . . always. Weighs only 120 pounds. Easy to get around fast. Can be carried and set up quickly on its sure-footed spring skids. Pumps anything from seepage to 5,000 gals. per hour. Pumps everything . . . water loaded with sand, gravel, mud, muck or goo. Built for long trouble-free life under toughest pumping conditions. Your nearest Homelite man is ready to give you an on-the-job demonstration. Write or call and he'll get in touch with you.

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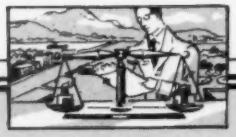
A DIVISION OF TEXTRON INC.
2104 RIVERDALE AVE., PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

There's Many a Slip

Casale v. Housing Authority of the City of Newark, 125 Atl. (2d) 895, a New Jersey case decided Oct. 5, 1956, was an action by husband and wife, who were tenants in an apartment house operated by the municipal housing authority, for injuries suffered by the wife from a fall on the sidewalk of the apartment house. She slipped on ice that lay on a stairway leading from the street level down to the entrance of the apartment house.

A maintenance man, employed by the Housing Authority, shovelled the snow from the stairway at 11 A.M. and 3 P.M. that day, but left a layer of hard ice, on which the plaintiff slipped that night.

The court found that the shoveling introduced a new element of danger which would not otherwise, have been present, but held that the Housing Authority was not liable.

The court said that a municipal corporation (like the defendant) is not liable for a nonfeasance in connection with a governmental activity, but is liable only for misfeasance. (In most states, no such distinction between misfeasance and nonfeasance is made; there is immunity in either case for governmental activity.) It was assumed that this was a case of governmental rather than proprietary activity, although this might have been seriously questioned. It was found that the shoveling was active misconduct, i.e. misfeasance. Thus, according to the New Jersey rule, there should have been no immunity. Nevertheless, the court held there *was* immunity, on the ground that the misfeasance was not under the *direction* of the municipality. Thus, the court refused to apply the usual master-servant rule. Therefore, the unusual exception to the general rule of immunity for governmental activities (i.e. in the case of misfeasance) was not applied because of another unusual exception to the general rule of liability of the master for the acts of his servant (i.e. in the case of misfeasance of an employee of a municipal corporation, the municipal corporation is liable only if it directed the act of misfeasance).

There were three judges deciding the case, and each gave a different opinion, disagreeing with much of what the other said. The case nicely illustrates the confusion and dissatisfaction with the rules of immunity of municipal corporations for their torts.

Woodsman Spare That Tree

Weibel v. City of Beatrice, 79 N.W. (2d) 67, a Nebraska case decided Nov. 2, 1956, was an action against the city to recover for damages to abutting property as a result of the removal of ornamental shade trees growing along the street when the city installed a new sidewalk after widening the street. The plaintiff claimed damages of $500.

On appeal, the court held against the plaintiff, saying: "Subject to the requirement that it must act in good faith and not abuse its exercise of power, the city has the power of control over its streets including parks and all spaces occupied by . . . trees . . .; and this power is paramount to any right . . . the grower of trees . . . may acquire thereon".

Underwater Real Estate

Nimmons v. City of La Grange, 95 S.E. (2d) 314, a Georgia case decided Oct. 30, 1956, was an action by a landowner against the City of La Grange for damages caused by the City's raising the grade of a street running in front of her property, causing a stagnant pool of wa-

ter to collect on her lot. She alleged a loss of $5500 in the value of her property as a result of this nuisance. The case was dismissed by the lower court on a technicality, but the appellate court held that she had stated a good case against the City and sent the case back for trial.

• • •

A Scottish Sewage Treatment Plant

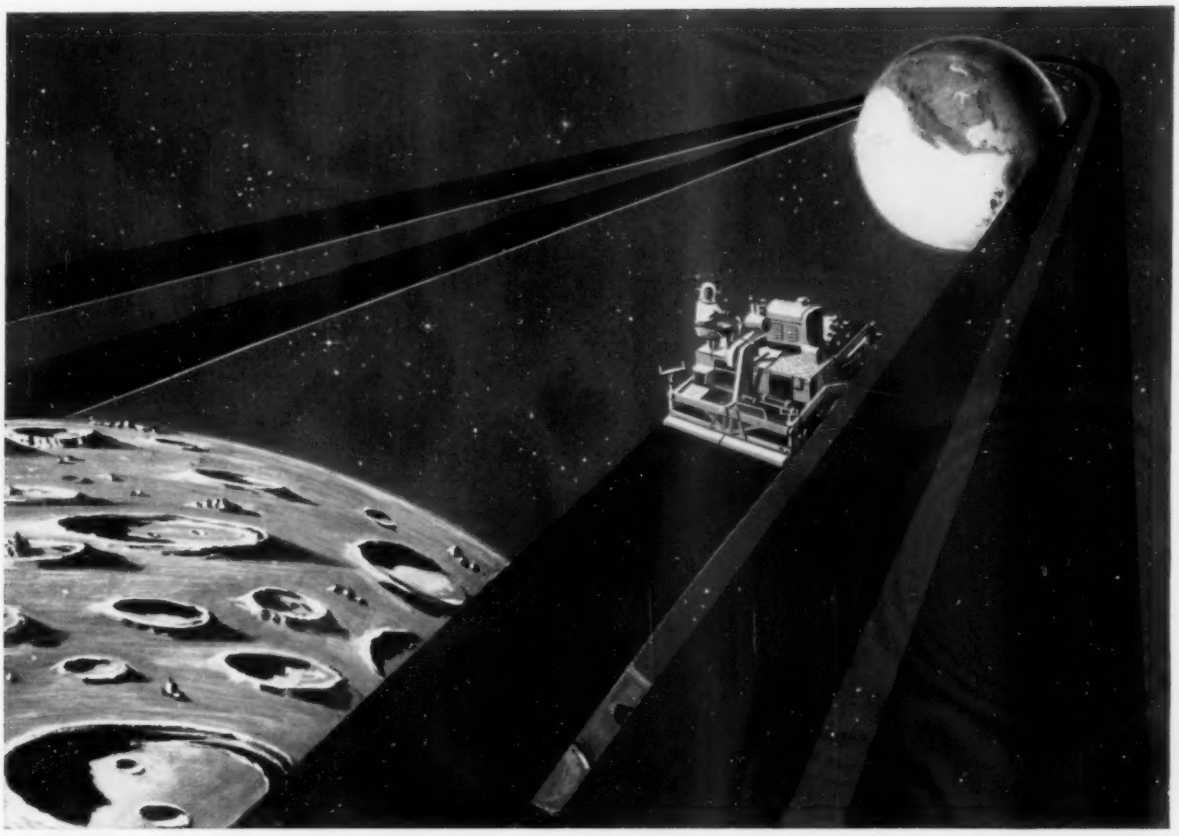
For some years now Scotland has shown commendable forethought in modern sewage treatment technique. Particularly is this noticeable for the smaller works, where up-to-date and in some cases advanced methods and equipment are being utilized. A plant for the burgh of Huntley, Aberdeenshire, was recently described in *Municipal Engineering*, as follows:

The sewage works is designed to serve a population of 4,500. Design was based on a water consumption figure of 50 gal. a head a day and the works has capacity to treat up to 12 times dry weather flow on a dwf basis of 225,000 gal. The screens and detritus channels are designed to deal with 2,700,000 gpd or 12 times dwf. From this point, flows up to 6 times dwf pass to the three sedimentation tanks, which provide a minimum retention period of 2 hours. Flows exceeding 6 times dwf are passed to the storm-water tanks for coarse settlement. A dosing chamber provides for the controlled operation of three 70-ft. dia. percolating filters designed to treat up to 3 dwf with a maxium dosage rate of 300 gal. a cu. yd a day. The filtered effluent passes through humus tanks before discharge.

The sedimentation, storm water and humus tanks are rectangular in design and each houses a hopper-type sludge collector at the inlet end. The tanks are mechanically desludged and, by clever design work, aided by a mechanical transporter carriage, the machine is available to all tank units.

All sludge is conveyed to a common sump, from which it is pumped to the digestion tank. The sludge digestion unit has a capacity of 12,500 cu. ft., and the tanks are 10 ft. deep. It is estimated that they are capable of holding approximately the sludge production for four months. After digestion the sludge is finally treated in drying beds; these have an area of 1,000 sq. yd. (4.5 persons a sq. yd.) and are in 16 units.

The plant, which cost £70,000, was designed by Jenkins and Marr, and the work is under the direction of the burgh engineer, Lt.-Col. I. Archibald, T. D.



The 5th (s)trip to the moon has been started

By conservative estimates, the thousands of Barber-Greene Finishers throughout the world have started paving their second million miles. That is the equivalent of more than four trips to the moon. The current design of the Model 879-B is based on that experience.

Improving the Barber-Greene Finisher is not new. Scores of major improvements have been embodied in its design since it was first released to the field 20 years ago. Each engineering advance is backed by experiences in laying every type of mix in virtually all conditions.

Latest improvements include:

New transmission — increases both operation and travel speeds, still provides 12 forward speeds for a wider range of operation.

Higher speed tamper — permits faster laying speeds and reduces maintenance costs.

New crawlers — precision-drilled pads and larger pins further decrease maintenance costs.

New power unit — 20% more power for pushing bigger trucks up steeper grades, with a greater reserve for high altitude and higher operating speeds.

Note to Barber-Greene Finisher Owners: *You can have any and all of these improvements on your machine. Necessary parts are available in kit form for each separate modification. Write for the folder describing the various kits.*

57-5-F

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

For low-cost, long-term weed control . . . use Du Pont **TELVAR**® weed killer

monuron or diuron

• Note how "Telvar" has kept the treated area free of vegetation. Untreated area at left shows type of heavy weed growth involved. "Telvar" comes as a wettable powder and is easy to apply with regular spraying equipment.

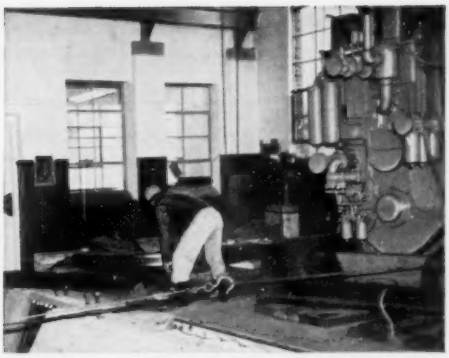
Just one application of a Du Pont "Telvar" weed killer controls weeds for a season or longer. That's because "Telvar" kills weeds through the roots, then remains in the soil to provide residual action long after the initial spray is applied. Low dosages mean a saving in handling and storage space. "Telvar" weed killers are non-corrosive to equipment, non-volatile, low in toxicity to humans and animals. For low-cost, long-term control of weeds, include "Telvar" in your program.

FOR BRUSH CONTROL . . . use Du Pont "Ammate" X weed and brush killer. It's the chemical brush killer with built-in safety; can be used even where treated areas adjoin sensitive croplands like tomatoes, soybeans, cotton, grapes and other crops. "Ammate" X is non-volatile; there are no vapors to drift onto crops.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada (1956) Ltd., 85 Eglinton Ave., E. Toronto 12, Ontario, Canada.

DU PONT REG. U.S. PAT. OFF. **Weed and Brush Killers**

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



The Enterprise DGSQ Turbocharged Dual Fuel engine is moved into place as a unit. With 16" bore and 20" stroke, it is rated 1422 HP at a speed of only 360 RPM.

Fourth Enterprise Engine arrives at Belleville under protective wraps of all-weather tarpaulin. This new addition adds 1000 KW to plant's capacity.

Bright Power Picture at Belleville: Better Schools and Streets, with Lower Taxes!

"We recently installed the fourth Enterprise Engine in our 100% Enterprise Dual Fuel plant. Our excellent experience with this equipment over the past eight years has proved it to be our best buy in engines. Operating and maintenance costs have been consistently low, greatly reducing power costs and helping make Belleville one of the most thriving and progressive cities in the middle west. We have better schools and streets, lower taxes, above-average recreational facilities, and many other advantages enjoyed by only very few cities of similar size."

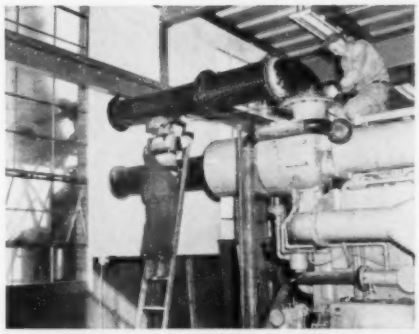
Earl E. Whitney, City Manager
Belleville, Kansas

City managers, municipal engineers, superintendents – all those concerned with the growth, the future, the prosperity of their community, can look to Enterprise Engines confident they will get this same kind of dependable and economical power-generating performance.

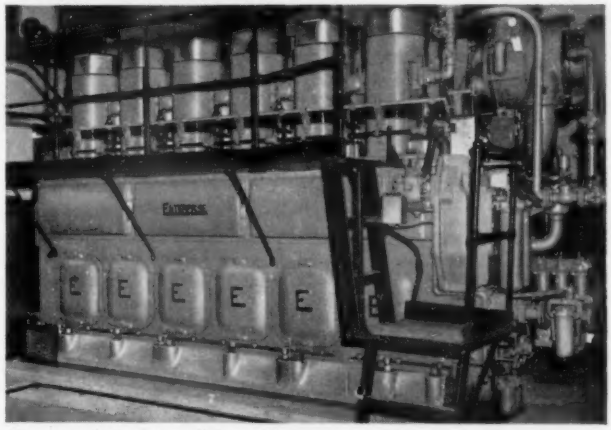
Enterprise Engines – Diesel, Dual Fuel, Spark Ignited Gas – serve every municipal need

The most modern engineering advances are reflected in every Enterprise model, from 73 to 6933 HP, for stationary or portable electric service, flood or water pumping systems, sewage plant power. See the Enterprise sales engineer in your area, or contact us direct for information or help with your plans.

Over a million horsepower at work the world over!



Installation nears completion as exhaust stack and muffler are installed. This "all Enterprise" plant, with its 2500 KW capacity, now has ample dependable reserve power for any emergency, future growth.



New member of the all Enterprise power team is cut in on the line. Low maintenance cost, excellent service record, and over-all economy of the Enterprise engines already in use were the big factors in its selection.

ENTERPRISE
dependable **ENGINES**

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California
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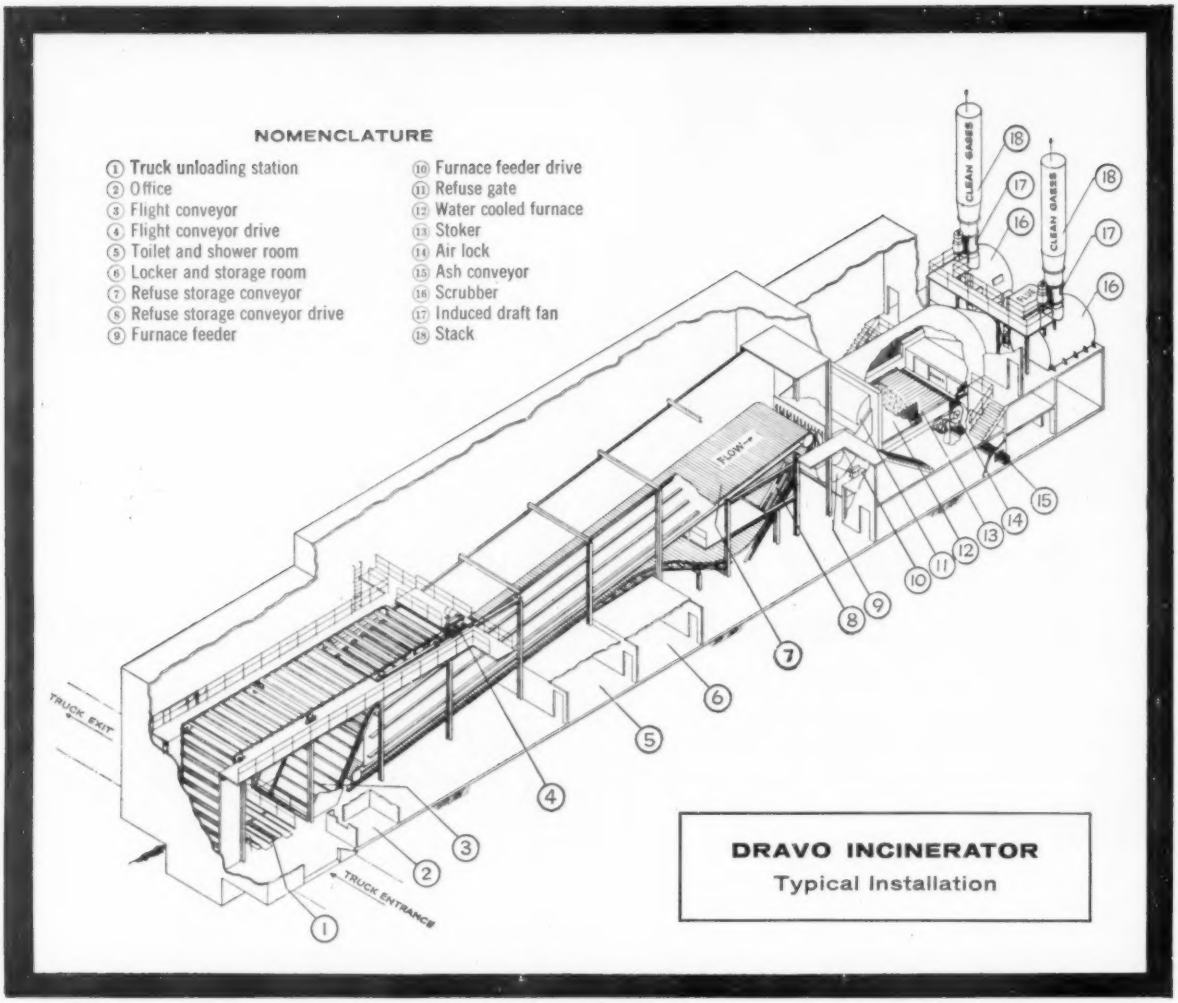

Low first cost—Low operating cost...

DRAVO INCINERATION

Dravo Incineration is scientifically designed to provide continuous, controlled combustion of all burnable refuse, regardless of moisture content. Combustion is so complete that there is no smoke and no odor. Fly ash discharge from the plant is far below code requirements.

Dravo Incineration is a complete process, including receiving system, automatic refuse handling system, automatic combustion controls, moving grate stoker, wet type flue gas scrubber, residue discharge conveyor and everything necessary for efficient plant operation with minimum personnel.

Dravo Incinerator plants are designed for economical construction and are available in unit sizes from 3 to 25 tons per hour. If yours is among the many communities that are turning to incineration for efficient refuse disposal, it will pay you to learn how Dravo Incineration can save you money in both first cost and operating cost. For complete information, write to DRAVO CORPORATION, DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

"Couldn't be sold any other Street Sweeper"

says CLYDE TERRY, Independent Contract Sweeper of Whittier, California

"AFTER 14,000 TOUGH SWEEPING MILES IN JUST NINE MONTHS—I'M CONVINCED!

"Only $90 was needed for repairs. Compared with other sweepers I've had, Mobil Sweeper costs are way down.

"Time is money to me—pay is on an hourly basis. Mobil Sweeper is 3 times faster to and from the sweeping job. This cuts my daily dead-heading time by hours... and gives me more actual sweeping time.

"Cleans slick as a whistle on the toughest jobs, such as final clean-up of freeways and streets of new subdivisions. Construction crews leave heavy debris and packed dirt that's tough to pick up. The variable speed brooms on Mobil Sweeper loosen and pick it up on the first sweep. With economy and performance features like this—I couldn't be sold any other street sweeper."

The record shows Clyde Terry puts more hard sweeping miles on his sweeper per year than most cities in a like period. Your community can have this same efficient sweeping at lower cost with a Mobil Sweeper. And remember, you get these extra safety features as standard equipment at no extra cost... 4-wheel hydraulic brakes, protective cab and safety glass windshield and windshield wipers. Get the performance you pay for with a Mobil Sweeper. Write for details on economical street sweeping—

Write today for Catalog P-4

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A Division of The Conveyor Co.

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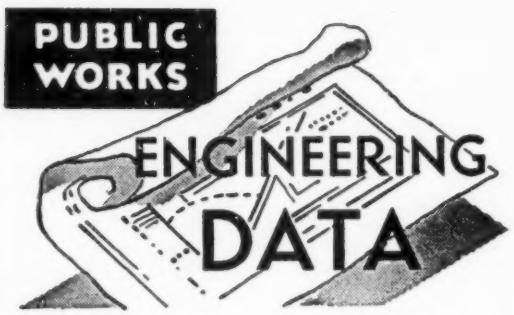

An English Rainfall and Runoff Study

A paper by L. H. Watkins, in the Journal of the Institution of Municipal Engineers (reported in Highway Research Abstracts) describes an investigation into the relation between rainfall and runoff. The catchment area included more than one-half the designated area of Harlow New Town. The results are given of an analysis of the records obtained over a period of three years.

The area time diagram method of calculating runoff curves gave good agreement with the recorded runoff curves, provided the calculated curves were corrected for storage and also were corrected by means of the total impermeability factor to make the calculated total runoff the same as the recorded total runoff. If the storage correction was not made, the calculated peak rate of runoff was sometimes as much as 200 percent greater than the recorded peak.

The total impermeability factor was not a constant, as is frequently assumed in surface-water sewer design calculations, but had a considerable seasonal variation, the trend being similar to that of the soil moisture deficit. This similarity between the trends of the impermeability factor and the soil moisture deficit might be expected at any similar catchment area containing a high proportion of undeveloped land and in which the main drainage system is a natural watercourse.

The variation in the impermeability factor would be considerably less at a more highly developed site or at one where sewers are employed throughout and where surface water from the paved area only would be expected to reach the sewers during the main runoff peak.

NIH Research Grants in Sanitary Engineering

Since the inception of the Public Health Service research grant program in 1947, a total of 422 grants received support amounting to $3.8 million in the field of environmental sanitation, according to a progress report released by the Public Health Service. This represents 2.2 percent of the funds awarded by the entire National Institutes of Health research program. Of the environmental health total, research projects in water supply and pollution control have received $2.07 million in aid; in air pollution, $0.77 million; in general engineering and milk and food, $0.52 million; and in occupational health, $0.38 million.

In the fiscal year 1956, the funds representing new grants in environmental health amounted to $614,124 and grants for continuing projects, $266,729. The total is more than 13 times the amount made available in the first year, 1947. In the last six months

TANDEM SPREADING of the Asphaltic Concrete speeded the resurfacing work as . . .

Bitumuls and Asphalt Put New Life in Famous Ridge Route on U. S. Highway 99

IN JUNE OF 1956, a contract for one of the largest resurfacing jobs to date was let by the State of California Division of Highways. This contract called for more than half a million dollars of resurfacing on a 41 mile stretch of the Ridge Route (U.S. Highway 99) between Los Angeles and the Kern County Line.

Because various types of existing pavements were involved in this project, the requirements for asphalts and Bitumuls to be used in the resurfacing operations were quite complex. For instance, the job called for 21 miles of multi-lane Asphaltic Concrete resurfacing; 13 miles of sub-sealing, crack-sealing, and priming of old rigid-type pavements ahead of resurfacing; 8 miles of sealing and priming of existing bituminous 4-lane roadway; and extensive shoulder work.

To meet these requirements, the quantities of asphalt and Bitumuls required are impressive; for sub-sealing, 1,700 tons of Grade 10-25 Air Refined Asphalt; for resurfacing, 3,500 tons of 200-300 Penetration Paving Asphalt; for seal and prime work, 140,000 gallons of Bitumuls.

Timing and coordination vital

Successful bidder on the job was Schroeder & Co., Sun Valley, California. Completion of the work was scheduled for January 1957, so speed was essential. Also, close coordination was required between the Engineers on the job and the Field Representatives of American Bitumuls & Asphalt Co. (supplier of all bituminous materials) to assure accurate timing and delivery of specific types and quantities of these materials.

On the old rigid-type pavements, slabs were drilled and sub-sealed with Air Refined Asphalt. Cracks and joints were filled and sealed.

Asphaltic Concrete (Paving Asphalt mixed with ½ inch to ¾ inch maximum-size aggregate) was plant mixed and trucked onto the job where it was spread in two lifts, to provide a uniform 3 inch thickness. Using two spreaders equipped with special shoulder extensions, this mix was placed to a full width of 37 feet in a single pass.

The existing bituminous pavement required only a 1 inch overlay of Asphaltic Concrete, as opposed to 3 inches specified over the rigid-type section. Ahead of the placement of this 1 inch thickness, Bitumuls Slurry Seal was used to seal and prime the old surface.

All asphalts from a single source

This job, because of its unusual size and many complexities, provides an excellent example of the ability of American Bitumuls & Asphalt Co. to deliver a full line of asphaltic products to meet every need; and to furnish the on-job field-service that can often mean the difference between profit and loss. Whether your next project is a resurfacing operation or new construction, check with our office nearest you for *all* your asphalt requirements.

BITUMULS SLURRY SEALING ahead of resurfacing on the existing bituminous roadway.

American Bitumuls & Asphalt Company
200 Bush Street
San Francisco 20, Calif.

of 1956, 104 grants were awarded to projects in water supply, water pollution and air pollution, totalling more than $1.46 million.

Applications for grants from institutions and individuals for environmental health projects are given their first review by a committee composed of non-federal scientists. The committee has been variously designated: First, as the Sanitation Study Section; later, Environmental Health Study Section and Public Health and Sanitation Study Section; and now, Sanitary Engineering and Occupational Health Study Section. Dr. H. F. Vaughan of the University of Michigan is the current chairman. Throughout the period of existence of the program, approval has been given to 53.3 percent of the applications submitted. The grants are awarded by the Surgeon General of the Public Health Service.

Protection Against Burst Pipes

A new English development is claimed to give cold water pipes permanent protection against bursts in coldest weather. The device consists of a narrow-gauge, airtight polythene tube (7 mm. diameter for use in normal half-inch pipes) which is inserted into the existing water pipes; when the water in the pipe freezes, the expansion of the ice compresses the tube, the air inside acting as a cushion and relieving the walls of the pipes of almost all pressure. On thawing, the tube returns to its normal shape. It is claimed that once installed, the tube requires no maintenance and will not deteriorate, and that treated pipes will take less time to thaw out than is usually the case. Although the tubing occupies about one-ninth of the volume of the pipe, the manufacturers state that the rate of flow is not diminished, as the water travels slightly faster in a treated pipe.

Radioisotopes Hasten Coliform Test

The delay in obtaining results of the coliform test for water is due to the criteria requiring visual evidence of colonies or gas production by the bacteria. Quantitative determination by the standard method requires that a single coliform bacterium must give rise to a population of 1,700,000,000 cells before the accumulation of evolved gas is sufficient to produce a visible bubble. Similarly, the membrane filter test requires an incubation period of 20 hours to allow the development of visible colonies.

Radioisotope detection instruments are capable of sensing particles many trillions of times smaller than a bacterium. If bacteria would incorporate unstable atoms, radiation from the harvested cells or from their metabolic products would indicate the presence of the bacteria, and if selected isotopes in quantities sufficient for subsequent detection were assimilated by small numbers of bacteria, a rapid method for bacterial determination might result. For example, if coliform organisms would ferment lactose made radioactive by the substitution of a carbon atom with carbon-14, the carbon dioxide evolved by the cells should be radioactive. Calculations based on reported respiration rates of E. coli indicated that the method was feasible. Because the fermentation of lactose with the production of gas containing carbon dioxide is the standard method presumptive test for coliform organisms, the radioactive technique should fulfill the requirements for that test.

Positive results have been obtained from very small numbers of organisms after as little as 10 minutes of incubation and a total elapsed time of 25 min-

. . . install CEN-VI-RO concrete pressure pipe and *forget it!*

Engineers for a pulp mill in the South specified this CEN-VI-RO 30" H100 Pipe to move 30,000 g.p.m. a quarter of a mile. Total installed cost was less than 70% of that of next most economical pipe considered.

Other factors influencing choice were

Strength Greater ability to carry external loads.

Durability High quality of concrete (over 8000 psi, under 2% absorption) and absence of exposed metal.

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If your problem is moving large quantities of water or other fluids, you need CEN-VI-RO Pipe. Let our engineers work with yours. Write or call

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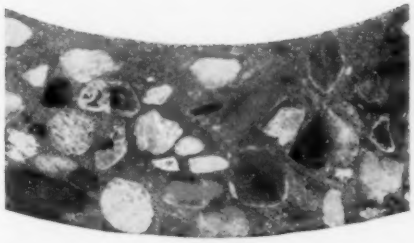

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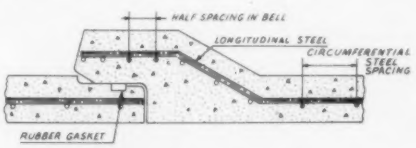

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utes. However, there have been times when the determination for small numbers of cells has taken several hours. More research is needed in order to determine the reasons for, and to attempt to control, this biological vagary. If the rate of CO_2 evolved by coliform organisms can be made reasonably uniform, it will be possible to obtain a quantitative determination. A significant factor in the variability of CO_2 production rates may be incorporation or retention of the gas by cells reproducing or preparing to reproduce. The use of poisons to prevent this is being investigated.

Since the project began, the amount of 1-C^{14} required per test has been reduced to the point where the radioisotope method can compete economically with the standard method. Radioactivity counting equipment required by the method represents an initial investment of approximately $1.000. The technique is simple and safe. Two important items, the Robinson gas-flow counter and the 1-C^{14} lactose, are not commercially available at the present time. These data are abstracted from an article by G. V. Levin, et al, in *The American Journal of Public Health*, 46:1405-1414.

Sewage Treatment Plant Factors Needing Better Design

An extended discussion of needed improvements in sewage treatment plant design, at a meeting of the Southern Section of Illinois sewage operators, resulted in the recommendations that: (1) needed pump capacity in lift stations be evaluated more carefully; (2) better control be provided for withdrawing sludge from settling tanks, with more rapid adjustment of telescoping valves and shelter for the operator who must remain at the sludge wells while drawing sludge; (3) an adequate system of walks be provided around the plant; (4) steep embankments be avoided or otherwise treated to prevent erosion and serious maintenance problems; (5) better ventilation of structures be provided; (6) fencing around plant grounds and railings around tanks be constructed; and (7) elimination of easily broken windows in outlying lift stations.

Liquid Alum used in Richmond Water Treatment

Use of liquid alum instead of dry alum will save Richmond, Va., about $10,000 per year, according to a recent report by the city. Savings due to easier handling will add another $5,000 annually. The liquid alum is delivered in a 3200-gallon truck trailer and is stored in an elevated water tank which has been converted to store 71,000 gallons of the liquid alum. A 3-inch rubber lined pipe is used to fill the tank from the truck; 1½-inch lines carry the coagulant to the points of application. The storage tank is lined with lead to a height of 8 ft. Three rotameters measure the alum, which is delivered by gravity.

The cost of converting to liquid alum was about $20,000, which is expected to be covered by the savings in the first 18 months of operation. Use of the liquid alum began last fall.

Odor Control in Sewers and At Sewage Treatment Plants

At a meeting of the Southern Section, Illinois Sewage Operators, the operator of the Mt. Vernon, Ill., sewage treatment plant reported highly successful use of a chlorobenzene for odor control both at the plant and at key points in the sewer system.

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Rock-Salt-Stabilized Roads Cost Less to Maintain

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In a great majority of cases, the product used for this modern stabilization technique is Sterling Rock Salt. Reason: Sterling Rock Salt—when used for stabilizing base courses and shoulders, as well as gravel roads—improves durability, and cuts maintenance costs in a number of ways.

Resistance to Moisture. During heavy rains the salt and fines in stabilized soil form a barrier to the seepage of moisture from any direction.

Great Density... is one of the important features of a rock-salt-stabilized road. This is achieved by the retention of water-of-compaction during rolling operations. Thus, the road resists weathering—which causes changes in the shape of roads.

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Rock-salt-stabilization procedures vary with particular soil and road conditions. For expert advice on how stabilization can work in *your* area, contact International. An International "Salt Specialist" will be glad to help you work out an effective, money-saving rock-salt-stabilization program.

He'll show you facts and figures on actual road-stabilization jobs. And he'll work with you on application procedures, specs, etc. Just contact your nearest International office.

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American Pipe Cleaning Company cleans sanitary sewers, storm sewers and water mains for municipalities which find it too costly to own and maintain their own equipment or to support the necessary force of skilled labor. APCO undertakes the *entire* cleaning operation, or supplements the basic program in use by the community.

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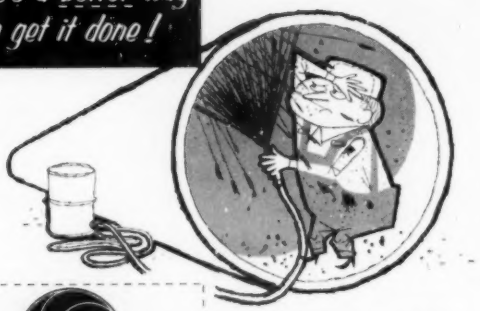

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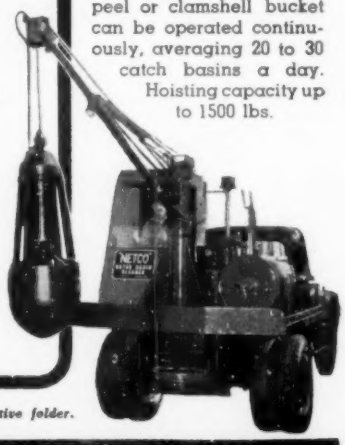

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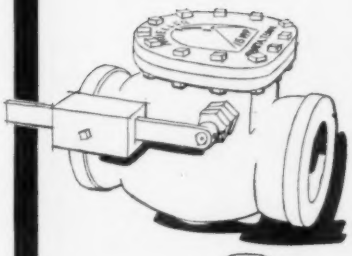
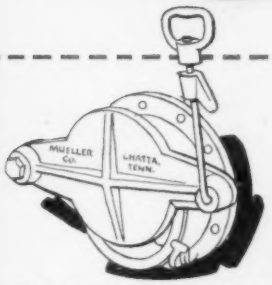


Shear Gates Iron body, bronze seat ring and disc ring. Flanged, hub or spigot frame. Sizes from 4" through 24". Furnished with 2' lift handle and catch. Gate latches 30° below horizontal. This design permits full opening of gate – no obstruction of orifice.



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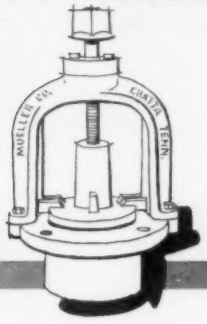

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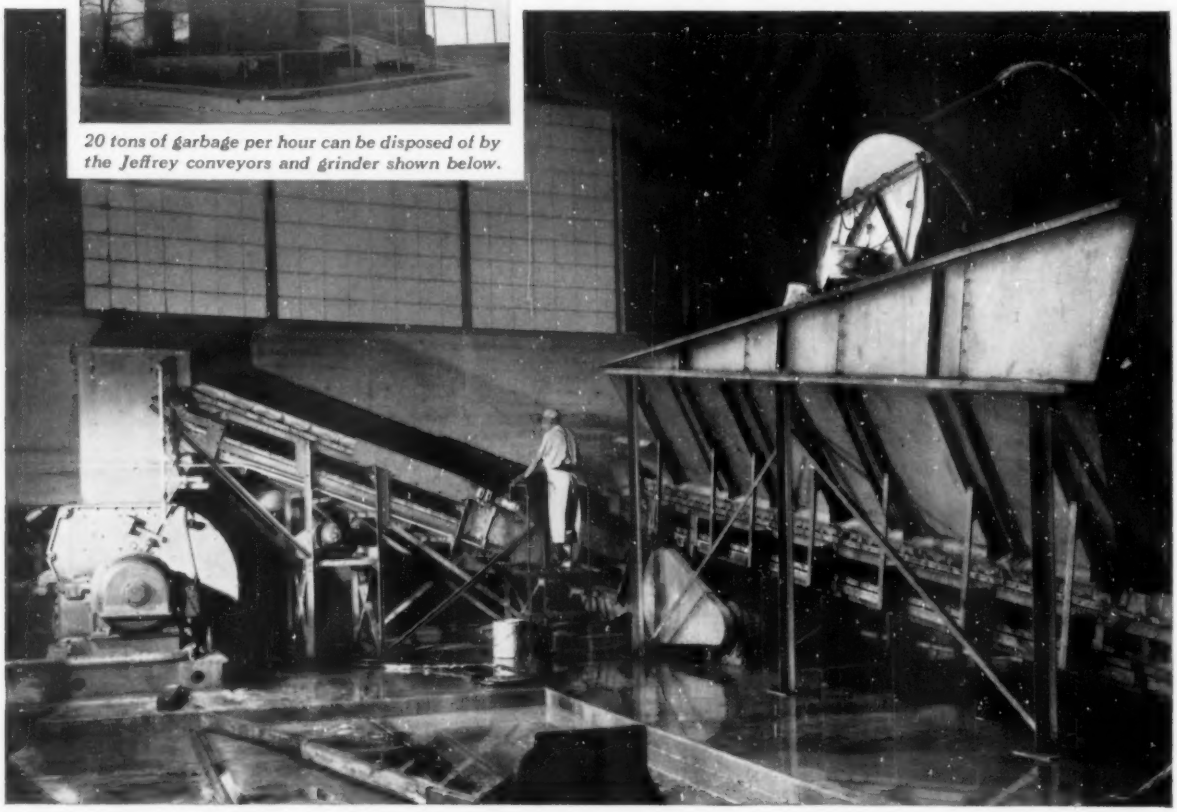
20 tons of garbage per hour can be disposed of by the Jeffrey conveyors and grinder shown below.

Only the excess garbage—peak loads during the summer, for example — is ground up here and discharged into the sewer. Most of it is hauled away by farmers for feed. But it's very much on the job when needed, say the men at this disposal plant in Washington, D. C.



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Collection trucks dump the garbage into the hopper from the floor above. A Jeffrey apron conveyor carries it to the inclined conveyor, which serves as a picking table. This feeds the Jeffrey 36″ x 36″ grinder.

Whatever your waste disposal problem, Jeffrey sanitation engineers offer you technical assistance on complete plant design and equipment. Catalog 905 describes Jeffrey equipment for such plants. The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

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. . . and congratulations from American Concrete to all those who helped make this award possible, including:

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ARCHITECTS
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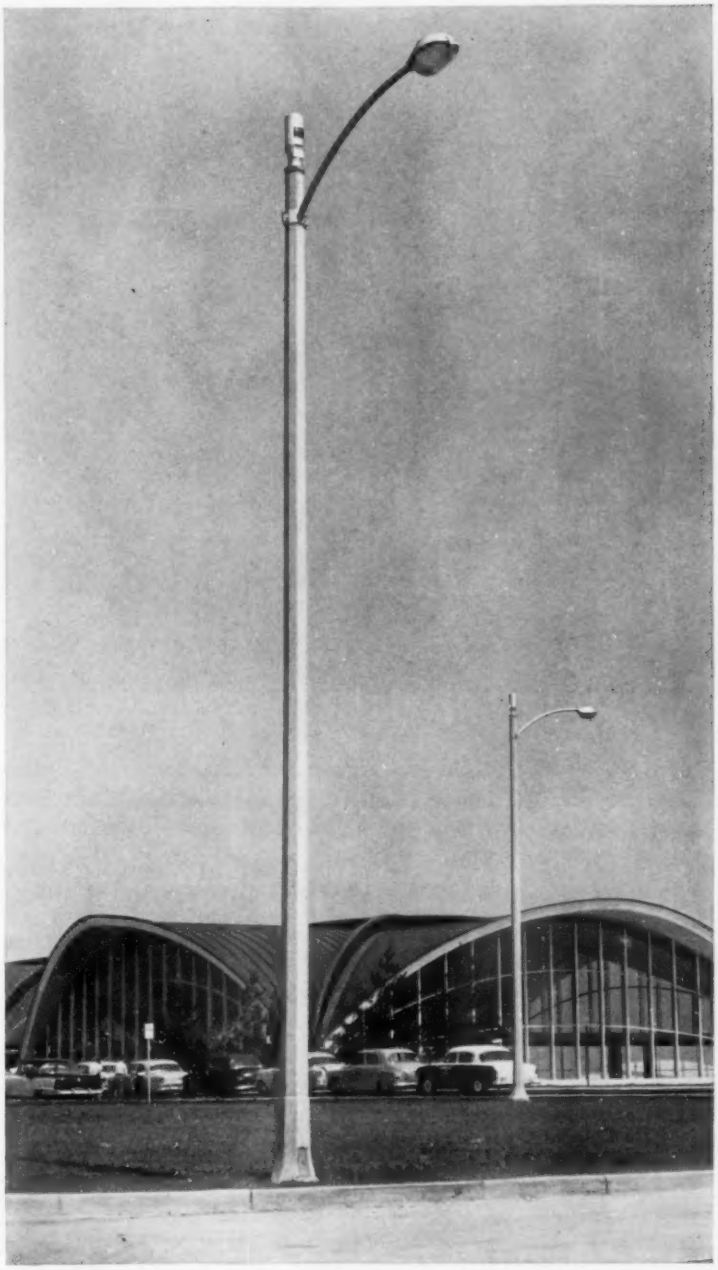
The American Institute of Architects recently selected the St. Louis Municipal Airport Building "First Honor Award Winner" . . . most outstanding building of the year.

Lighting of the airport grounds is provided by American Concrete prestressed Hy-Lite lighting standards, mounting mercury vapor luminaires.



The attractive granite finish of these Hy-Lite Standards blends perfectly with the modern design concept of the St. Louis Air Terminal.

American Concrete 5092 N. Kimberly Avenue, Chicago 30, Illinois

PRESTRESSED CONCRETE LIGHTING STANDARDS

On a sanitary landfill operation

THIS NO. 933 TRAXCAVATOR* HAS CUT FUEL COSTS

70%

Before buying a CAT* No. 933 Traxcavator to handle its sanitary landfill operation, the city of Havana, Illinois, was paying $47 per month to fuel another machine. The No. 933—which burns a non-premium fuel—slashed this cost down to $14 the first month, a clear 70% saving.

Mayor Clarence I. Chester says the city expected a fuel saving—but that they were doubtful whether the No. 933 was large enough for the job. "Now we feel that it's the best unit we have ever had on the sanitary landfill," he says. "The No. 933 handles all operations easily."

The landfill is on a 20-acre area owned by the city. The No. 933 clears timber, piles it for burning, excavates trenches—then spreads and compacts refuse before covering it with two feet of earth. Working two or three hours a day, the Traxcavator handles about 400 cu. yd. of refuse per week. (Note: Havana plans to plant Christmas trees on the landfill eventually and make enough on the trees to pay for the land.)

Here are some of the features that make Caterpillar-built Traxcavators ideal for any sanitary landfill operation: 40-degree tilt back of the bucket at ground level to assure full loads on every pass; one-hand bucket and lift controls for quick, easy operation; and balanced, unit design that enables Traxcavators to handle a heaped bucket in faster cycle time.

There are three Traxcavators in the Caterpillar line—the No. 933 (50 HP, 1 cu. yd. bucket capacity), the No. 955 (70 HP, 1½ cu. yd.) and the No. 977 (100 HP, 2¼ cu. yd.). Let your Caterpillar Dealer demonstrate the one best suited to *your* needs on *your* job. You can count on him for expert advice—and reliable parts and service after you buy.

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WANTED—
THE HARD WORK

PUBLIC WORKS
Magazine
Vol. 88, No. 4 April 1957

MUNICIPAL GOVERNMENT RESPONSIBILITIES in an *ATOMIC AGE*

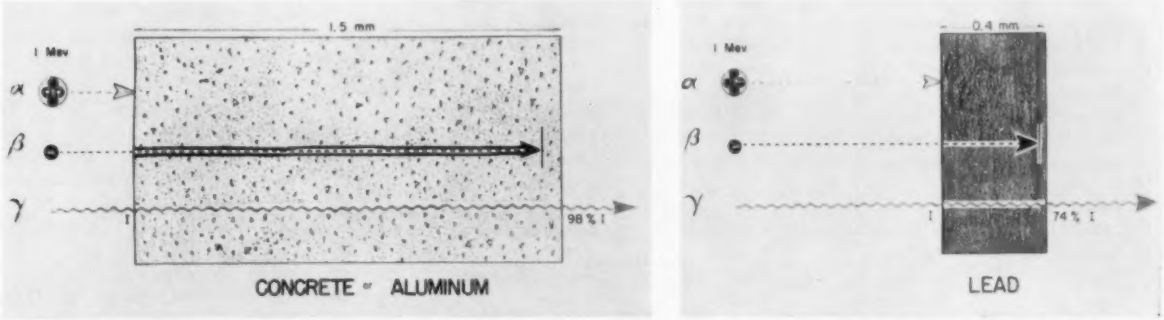
MITCHELL R. ZAVON,
Director,
Occupational Health Services,
Cincinnati Health Department,
Cincinnati, Ohio

SINCE THE END of World War II, radioactivity has become as much a household word as radio was prior to World War II. Radioactivity as a health hazard thus far has not increased in proportion to the interest and discussion of the subject. But it cannot be denied that all uses of radioactivity have increased tremendously since 1945 and bid fair to continue to increase in the years to come.

When we talk of radiation and radioactivity, we are talking of waves similar to light waves, but more penetrating; and of particles, some of which are identical to the electrons which make up a current of electricity. Figure 1 shows the common types of radiation and gives some of their characteristics.

Depending upon the type of radiation, the radioactive emanations may be stopped by a thin barrier or require thick walls of concrete. The latter is required around a nuclear reactor if it is not immersed in a water bath or buried in the ground. An X-ray machine, used infrequently, may require no special barriers other than the regular walls of the room in which it is located. If used a great deal, the same machine may require additional surrounding barriers to protect persons in the area. Sometimes the best place to have the radioactive material is as far away as practical.

We might divide the types of radiation into two categories: man made and naturally occurring. Man made radiation in the form of X-ray is still the commonest source of radiation and will probably continue as the major source for some years to come. X-ray machines may be found in many locations as hospitals, medical clinics, shoe stores, research laboratories and industrial plants. The common X-ray machine, and I include the shoe fluoroscope in this category, operates at anywhere from 15,000 to 400,000 volts with the



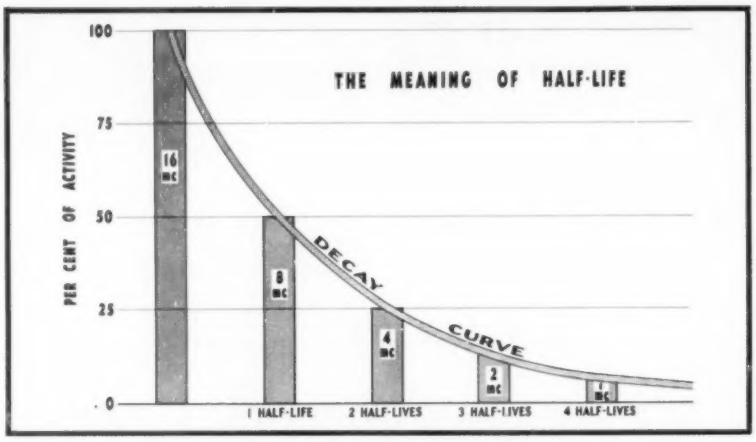
● **FIG. 1. RADIATION absorption by shielding materials. Penetrating gamma rays occur as radioelements decay. See Table 1.**

majority in the 75-200,000-volt range and a few at 1,000,000 volts or more. It is evident that this is a high voltage installation and it requires the same supervision as other such high voltage installations. Many of the X-ray machines in use today will be found to be electrically defective and to constitute a shock or fire hazard.

Other sources of man made radiation include such devices as the high energy accelerators. Betatrons, Cyclotrons, Synchrocyclotrons, Linear Accelerators and many others are included in this group. These are used in hospitals, college laboratories and industrial plants. The accelerators take an atomic particle and move it rapidly against a target in order to break it into fragments or produce other particles or X-rays. Common to all such instruments is the use of electrical current at high potentials and common to these, as well as to the ordinary X-ray tube, is our ability to pull a switch and turn off the radiation.

Radioactivity which cannot be turned off by throwing a switch arises from the decay of radioactive materials. Such radioactive materials may result from bombardment of non-radioactive materials in a nuclear reactor, bombardment in a high energy accelerator, or the explosion of atomic and hydrogen bombs. Other radioactive materials occur naturally and are widely distributed. Uranium, thorium and their daughter products, which include radium, are naturally occurring radioactive elements.

The isotopes of an element may or may not be radioactive. Isotopes of the same element are chemically the same but have different weights.



Thus, for instance, all lead is chemically the same, yet lead-206 and lead-207 are stable, non-radioactive, while lead-210 is radioactive. Lead-210 differs in its weight from the other isotopes of lead as 210 differs from 207 or 206. All radioactive elements decay as they emanate their radioactive particles and waves, transforming their decayed mass into energy. We generally call the time it takes for one-half of the material to decay, its *half-life*. In the case of lead-210, the half-life is approximately 22 years. In other words, if in 1957 we have 10 grams of lead-210, in 1979 only 5 grams will remain. In the year 2001, 2.5 grams will be left, and so on until infinity. Some elements decay to stable isotopes, others go through several steps of radioactive decay before becoming stable. The product of the decay is usually referred to as the daughter and may or may not be radioactive in its turn.

Radiation as a research tool, as a means of non-destructive testing, for quality control as a tool of diagnosis and therapy, and for a thousand-and-one other uses is a reality today and its uses are increasing constantly.

There are two separate responsibilities of government as it pertains to protection of the population from the possible hazards of radiation and radioactive materials. The government must see that the public is not unknowingly exposed to amounts of radiation which might be hazardous to health. Some states and municipalities have decided that their responsibility in this direction includes protection of the person at work, as for instance, the X-ray technician in the hospital. On the other hand it is necessary to protect the municipal worker from unknowing exposure. The fireman fighting a fire should know what precautions are necessary if he is apt to be exposed to radiation. Likewise the refuse collector should not be unknowingly exposed to radiation in the trash he is collecting.

In order to fulfill governmental responsibilities to the public and to the persons working at governmental jobs, there are several basic steps which ought to be followed. These are: (1.) Determine what sources of radiation exist in the community, the magnitude of these sources, the method of disposal of waste radioactivity, and the number of people potentially exposed to the radiation; (2.) Determine who is now concerned with, and actively supervising in any way, the matter of radiation protection in industrial, medical, and research organizations, and who is doing local planning for radiation disaster; (3.) Determine the number of personnel with knowledge of radiation and radiation physics, the extent of their knowledge and the availability of these persons.

Table 1—Uranium Decay Scheme

Radioelement	*Historical Name*	*Half-Life*	*Radiation Type*
Uranium 238	Uranium 1	4.49×10^9 yrs.	Alpha, Gamma
Thorium 234	Uranium X_1	24.1 days	Beta, Gamma
Protactinium 234	Uranium X_2	1.175 mins.	Beta, Gamma
Uranium 234	Uranium II	2.48×10^5 yrs.	Alpha, Gamma
Thorium 230	Ionium	8.0×10^4 yrs.	Alpha, Gamma
Radium (caps) 226	Radium	1622 yrs.	Alpha, Gamma
Radon 222	Ra Emanation	3.8 days	Alpha
Polonium 218	Radium A	3.05 mins.	Alpha, Beta
Lead 214	Radium B	26.8 mins.	Beta, Gamma
Bismuth 214	Radium C	19.7 mins.	Alpha, Beta, Gamma
Polonium 214	Radium C^1	1.6×10^{-4} sec.	Alpha
Lead 210	Radium D	22 yrs.	Beta, Gamma
Bismuth 210	Radium E	5 days	Beta
Polonium 210	Radium F	138 days	Alpha, Gamma
Lead 206 (end product)	Radium G	Stable	Stable

Discussing each of these steps in turn, we start with the matter of sources. Physicians, dentists, veterinarians, chiropractors, osteopaths, and other members of the healing professions are apt to have X-ray equipment and may have radium. The Atomic Energy Commission sends notification to each State Health Department of monthly shipments of radioisotopes to that State and the name and address of the recipient. Such information should be available to the municipality through the state health department with the local health department possibly acting as the immediate recipient of information. The A. E. C. supervises only Commission-produced isotopes or those produced by its contractors. Some radioisotopes produced in University-owned cyclotrons are not subject to Federal control nor is any of the radium. This last element is widely distributed. There are numerous stories of radium capsules being lost in sewers, in public streets, or in hospital corridors. Anyone may buy radium if he has the wherewithal to do so, and there is no Federal supervision of radium.

Concern with radiation cuts across many jurisdictional lines, but who will have become concerned with the subject is a variable governed by many factors. The actual location of radioactive materials may concern the Fire, Police and Health Departments. The disposal of radioactive wastes would come within the purview of Health and Sanitation. The department responsible for water supply must consider the normal radioactive content of the water, for there is a certain amount of radioactivity normally present. They should determine what would be done in case of significant radioactive fallout after a bombing or a bomb test. The water supply in Troy, New York once had to face this problem. Would you know what to do, and does your department have the equipment to monitor its water for radioactivity?

Radioactive wastes may overburden a disposal system if they are discharged without adequate advance planning. Several questions are appropriate at this point. Is the radioactive waste in your community flushed down the drain, disposed of by an A.E.C. licensed vendor, or buried? If it is buried, do the proper municipal authorities know the quantities disposed of in this manner and its exact location? Who has the responsibility for all of this supervision?

Though the A. E. C. is charged with primary responsibility for safe use and disposal, it is doubtful whether such Federal regulations can or should be allowed to absolve our local governmental units of their responsibilities for the protection of the population in their jurisdiction. A. E. C. inspectors cannot be everywhere at once, and the use of radioactive material not supported by the A. E. C. is considerable. Numerous examples can be given of spills of radioisotopes, burial without proper marking, loss of radium, use of X-ray equipment by untrained persons, and use of grossly defective shoe fluoroscopes. In many such cases the local authorities have not been prepared to grapple with this relatively new problem.

The question of personnel is a constant problem among municipalities. Either specialized personnel are unavailable or the salary level can't attract them. In formulating an overall approach to local radiation problems, personnel may be available from State or Federal agencies for assistance in planning.

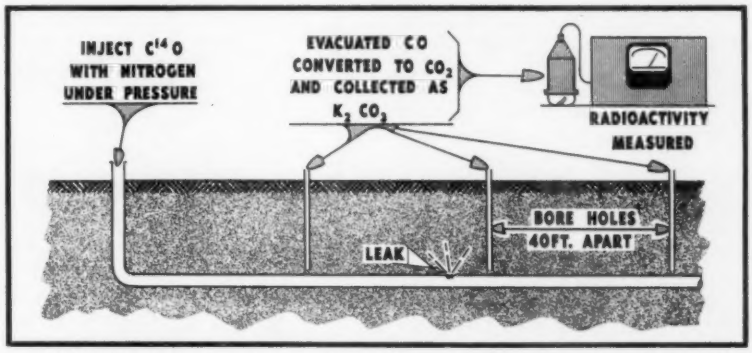
The radiation detection equipment needed by the water works, the health department, fire and police departments, and other municipal departments may be called on for double duty as part of the local disaster equipment. Some civil defense equipment may not be suitable for peace time use and vice versa, but the majority of the needed equipment will be readily adapted to either type of use and might be purchased with this thought in mind. With an adequate initial expenditure of time and thought the cash outlay for equipment can be minimized.

The community that recognizes its responsibilities for control of potentially hazardous materials without erecting barriers to their use is approaching the problems of modern technology in a constructive fashion. Such a community will grow with the times. Though it is easy to prohibit, it is far more desirable to work out safe procedures for use. It is the responsibility of municipal government to be aware of radiation and its hazards and to learn to live with this new aspect of modern life.

Learning may be facilitated by sending personnel to one of the short courses offered by the following institutions: Institute of Industrial Health, New York University, New York City; Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee; or the Robert A. Taft Sanitary Engineering Center, U. S. Public Health Service, Cincinnati, Ohio.

Illustrations courtesy U. S. Atomic Energy Commission

● **USES OF radioactivity in municipal work include tests of paving materials to measure the bond between asphalt and stone and to determine materials' durability.**



● **LOCATING leaks in underground conduits with radioactive carbon. This method has the advantages of great sensitivity; the test is simple and inexpensive to conduct; and there is no interruption to normal service while test is being performed.**

HIGHWAY PLANNING *for the* SMALL CITY

The Traffic Story
How Many Cars?

JACOB MENDE

EVERY MOTORIST is an expert on traffic. The engineer who has the responsibility for planning and building the highway system in the small town can only listen in silence, while going ahead with his professional job. Like a doctor, an engineer has to diagnose the disease before prescribing the treatment. Traffic congestion is only the symptom, not the sickness.

There are two sides to the traffic story: 1) how many cars; and 2) where are they going?

Counting the traffic requires careful planning and organization. For reasons of economy it will not usually be practicable to make continuous counts on even the heavily traveled arteries. Recording type counters, which print the count every hour on a tape, cost in the neighborhood of $407 with battery. Added to this cost is tubing at 10 cents a foot, plus the necessary clamps, chains, padlocks, etc. Then too, counters must be checked regularly and tapes removed weekly. Inevitably tubes get worn out or broken, batteries must be replaced, and other repairs made. Smalltown budgets usually won't stand the strain, so a more modest program must be planned.

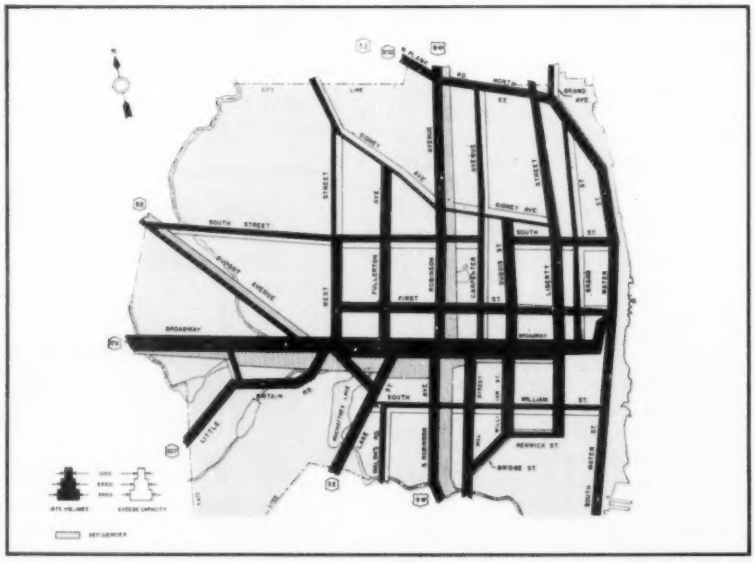
The volume census, or traffic count, is designed to give the planning engineer the overall traffic pattern on his road network. As desirable as it would be to have continuous counts on all the area roads and streets, a satisfactory compromise with the budget can be made by taking 12-hour counts on a summer week-day. If necessary, these counts can be spread over several weeks to make up for personnel shortages.

Tuesday and Thursday represent a typical week-day in smaller communities; Wednesday is typical in very large cities. During July and August a Tuesday or Thursday 12-hour traffic count will include a peak hour that falls within the range of the 30th to 50th highest hour in the year. This hour is the design hour which is commonly used to determine the geometrics of the planned highway.

The first step, then, in the counting program, is to schedule a traffic survey for a Tuesday or a Thursday in July or August. An outer cordon should be established at every entrance to the city or village, and an inner cordon should be set up around the business district. These counts represent the minimum coverage. Personnel can usually be drawn from the young people's groups, such as Boy Scouts, Girl Scouts, Church Clubs, etc. Since the project is on a civic pride basis, the utmost in tact is required to get the cooperation of volunteers. Suitable publicity before, during, and after the survey is a great help.

Again, in the interest of economy, counts should be made manually, rather than by push-button denominators, which cost from 19 to 22 dollars each without mounting. The traffic counting forms should indicate for each hour the direction of traffic and should classify by type as to passenger, light and heavy trucks, and busses.

The results of the volume census may come as a shock even to the engineer. So often people speak knowingly of a "lot of traffic," which is comparable to a "piece of string." Congested Main Street may have a 12-hour volume of 4600 while free-flowing Broadway may carry 5400. But whatever the figures turn out to be, they will be facts, not guesses.



● **PREDICTED 1975 traffic volumes in Newburgh, N.Y., assuming no improvements**

The traffic facts should be plotted in a series of three maps. The first should show 12-hour volumes, or the total in both directions recorded during the survey. Although this map can not be used for design, it shows the comparison between streets as to the traffic service rendered by each. All other considerations being equal, the 12-hour volume map will guide the engineer in programming street improvements on the basis of caring for the high volume streets first.

The map scale will vary, depending on the size of the area and the traffic volumes. Scales should be chosen so that the widest traffic band will not overlap the band on a parallel street. For volumes up to 5000 in a 12-hour period, a scale of 6000 to 8000 vehicles equals one inch will show to advantage on an 18″ x 24″ map, which reduces conveniently to a 9″ x 12″ sheet for the engineer's report to the Council.

The next step in translating the traffic story for the layman is to forecast the traffic 20 years hence. Highways, like people, have different potentialities. The planning engineer here will be guided by judgment, knowledge of his area, and the estimated pattern of community growth. Various methods are used for estimating increases, ranging from curves to straight line graphs, with or without allowances for induced traffic, development traffic, created traffic and similar conditions. The simplest method for the smaller community will be the use of five factors: 1.2; 1.6; 1.7; 1.8; and 2.1; depending on the importance of the street and the anticipated growth. Thus the small-town planning engineer might use a factor of 1.81 for Main Street, 1.71 for Broad Street, etc.

These forecast increases are shown to best advantages as additional widths on the 12-hour volume bands. These bands representing current traffic are usually shown solid, while the forecast volume increases are shown open or hatched for contrast. Both bands will of course be plotted to the same scale. This traffic plate tells an interesting story to the layman as well as the engineer, and helps put across the point of programming improvements on the basis of traffic service.

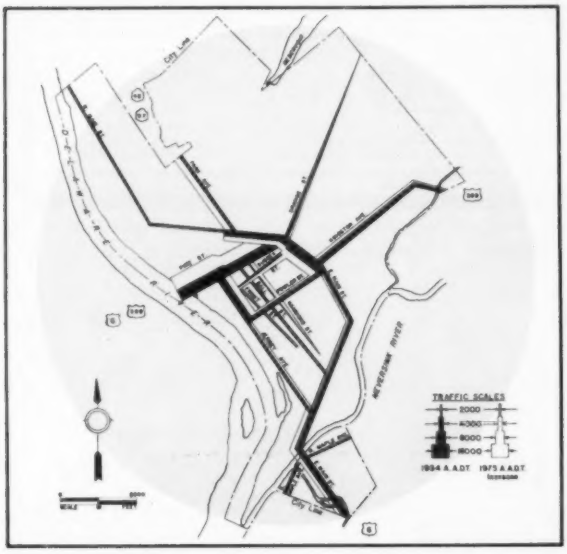
To round out the volume story, the peak-hour volumes should be plotted almost in the same fashion as the 12-hour volumes. Usually the heaviest traffic of the average weekday will be recorded from 5-6 P.M., when factory, store, and office workers go home, and housewives hurry back from shopping to start the evening meal. The morning peak, from 7-8 or 8-9, depending on the locality, is normally lighter.

The heaviest hourly directional volume on each street should be doubled, then plotted to scale on an 18″ x 24″ base in the same manner as the 12-hour traffic. This peak hour plate will then show the theoretical traffic service that the street system has to provide for. There will normally be only 30-50 heavier hours in a year, and it will be uneconomic to design for these peak hours.

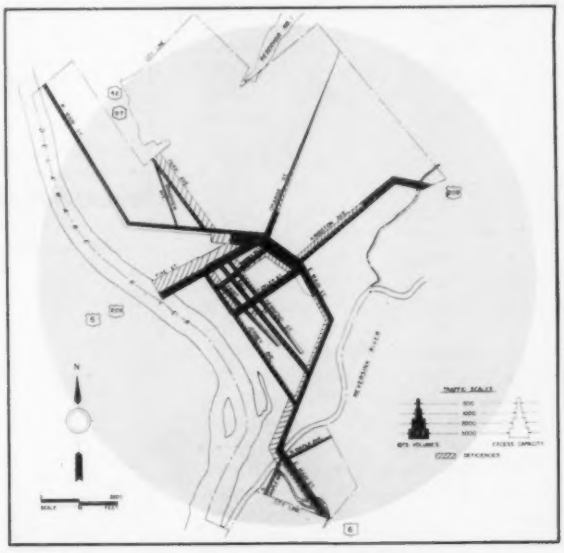
The capacity of a street to carry its peak-hour traffic is obviously a function of its width, excluding short sections of taper, etc. The Highway Capacity Manual published by the U.S. Bureau of Public Roads provides the necessary capacity information for all conditions of street widths, parking, traffic signals, etc. By plotting the street capacities on the same plate as the doubled one-way peak hours, the engineer has a graphic story of traffic overloads or reserve traffic capacity that will be understandable to the civic fathers. This plate also can be conveniently reduced to a 9″ x 12″ size for the engineer's report.

Applying the same forecast factors as for the 12-hour plate, the estimated peak hours should be plotted for the 20 year forecast period. Since the street capacities will be shown as is, unless major improvements are planned, many of the streets will have theoretical overloads, and others will be near the limit of their capacity. This peak hour study will point the finger at the sore spots in the street system.

The 12-hour traffic plate with its companion peak-hour plates will tell a traffic story that cannot be denied. "A lot of traffic" may indeed be a lot, or only a little. The engineer will have the facts.



● **COMPARISON of traffic volumes made by an actual count with that anticipated 20 years hence. This map shows annual average daily traffic; 12-hour volumes give similar results.**



● **FUTURE trafifc volumes are computed and plotted on a map. Actual street capacities are then superimposed to show which of the streets will have deficiencies needing correction.**

Prevent Bridge Failures

F. J. RUSSELL

Engineer of Maintenance,

Mississippi State Highway Department

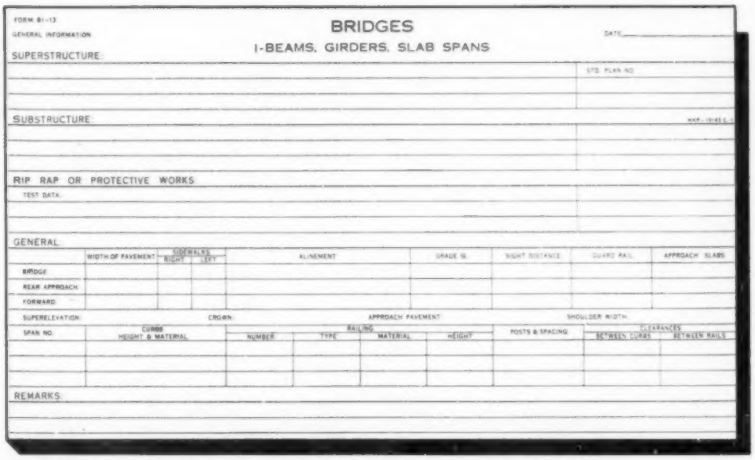
THERE ARE 3419 bridges on the 8350 miles of the Mississippi State Highway System; all structures with a clear span of 20 ft. and over are classed as bridges, including box type concrete structures with a total of 20 ft. clear span, whether having one 20 ft. clear span or two or more barrels totaling 20 ft. of clear spans. Our bridges include many designs; they are of creosoted timber, reinforced portland cement concrete and steel; they are of various ages up to 35 years and range from 20 ft. to 1.9 miles in length. The Mississippi River Bridge at Natchez is maintained jointly by the Louisiana Department of Highways and the Mississippi State Highway Department. The following list shows the number of bridges constructed of the various materials or combinations of material:

Reinforced Concrete, 604; Steel, 6; Treated Timber, 1266; Reinforced Concrete & Steel, 648; Reinforced Concrete & Treated Timber, 19; Steel & Treated Timber, 43; Steel, Reinforced Concrete & Timber, 810.

All bridge maintenance work is done by full time maintenance employees of the State Highway Department. The bridge maintenance crews are under the supervision of the district engineers with the exception that one bridge painting crew is under the supervision of the central maintenance office. This state-wide bridge painting crew is assigned to jobs of repainting the major steel bridges. From late spring to fall the crew works in the extreme north section of the state and in the southern section in the winter where they lose very little time due to low temperatures.

Steel bridges are cleaned with a sand blast before repainting. Paint is applied with pneumatic spray guns. One coat of red lead is applied to the clean steel and two coats of aluminum paint are placed over the red lead.

Highway Department specification paints are used for repainting bridges. Paints are purchased under contracts awarded on the basis of prices submitted on competitive bids. Our present prices are: red lead in 1-gallon containers, $4.88 per gallon; and aluminum paint in 5-gallon containers, $2.17 per gallon delivered.



FORM BI-13
GENERAL INFORMATION

BRIDGES
I-BEAMS, GIRDERS, SLAB SPANS

DATE

SUPERSTRUCTURE

STD. PLAN NO.

SUBSTRUCTURE

RIP RAP OR PROTECTIVE WORKS

TEST DATA

GENERAL

	WIDTH OF PAVEMENT	SIDEWALKS RIGHT	SIDEWALKS LEFT	ALINEMENT	GRADE %	SIGHT DISTANCE	GUARD RAIL	APPROACH SLABS
BRIDGE								
REAR APPROACH								
FORWARD								

SUPERELEVATION | CROWN | APPROACH PAVEMENT | SHOULDER WIDTH

SPAN NO.	CURBS HEIGHT & MATERIAL	RAILING NUMBER	RAILING TYPE	RAILING MATERIAL	RAILING HEIGHT	POSTS & SPACING	CLEARANCES BETWEEN CURBS	CLEARANCES BETWEEN RAILS

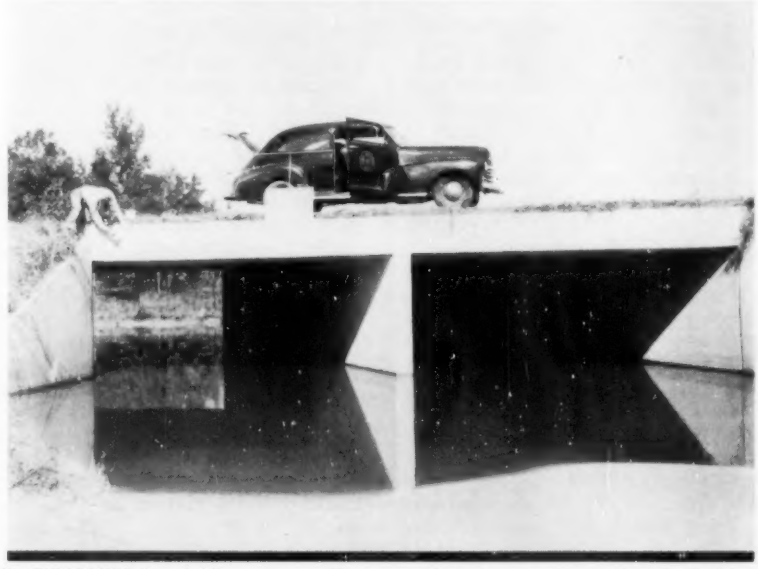
REMARKS

● **BRIDGE record form. This one is for I-beam, girder and slab spans. Reverse of form contains full description of superstructure and substructure, with details.**

We do not determine the cost of repainting bridges on a per ton of steel basis because of the variety of designs, difference in sizes of structures, and the difference in the conditions of the steel to be repainted. Also the changes in the cost of labor, material, and equipment operations during the past few years have made it more difficult to arrive at a fixed unit cost.

Concrete Bridges

Our concrete bridges show practically no deterioration due to weather or the elements, and none due to internal causes. Movement caused by expansion and contraction is the cause of the most de-



● **CONCRETE box bridge over small stream. Guard rail not yet placed. Maintenance has been low on this type of bridge and necessary repairs are not difficult.**

with Adequate Maintenance

terioration. This movement may disrupt the concrete at the end of caps and beams, and close expansion joints. Bridges of recent designs with open expansion joints and good bearings show very little of this kind of distress. When the expansion joints are closed, the beams are jacked to their proper position. Spalls at the end of beams and caps are torn out and the concrete is replaced with high early cement concrete with Embeco added to the mix. We have had no failures of such patches due to shrinking and cracking. The floor surfaces of a few old bridges have become worn and rough from traffic. This condition is corrected by adding a 2 to 3-in. mat of bituminous concrete wearing surface. There is no deterioration of concrete railing and curbs due to natural causes. Many bridge rails are damaged by motor vehicles striking them; this usually occurs where the width of the bridge is inadequate for present day traffic.

One cause of trouble in concrete floors of bridges that requires constant maintenance is the infiltration of foreign matter in expansion joints. This condition is worse in some locations, but expansion joints in all concrete bridge floors eventually become clogged with sand, pebbles, and other foreign matter. It is often necessary to resort to picks and pneumatic tools in order to remove the material. After the joints are cleaned of foreign matter, oakum is packed into the joints to within 1½ in. of the floor surface and joint sealing compound is poured over the oakum to within approximately ¼ in. of the floor surface.

Timber Bridges

The standard creosote timber bridge consists of 4-pile bents, 12 x 12-in. caps, 10—6 x 14-in. stringers per span, and 3-in. plank flooring covered with a 2-in. bituminous mat. With the best creosote treatment, deterioration due to rot begins at the center of the piles at about 12 years. Seasoning cracks open to a considerable depth in piling; this lets moisture in and deterioration is accelerated due to fungus and termites. Piles which are 20 to 30 years old are hollow with a shell from 1 to 3-in. thickness. Increase in the volume of traffic and the number of heavy loads has resulted in broken stringers and floor planks. Also increased speed and weight of loads cause considerable vibration, draws floor plank spikes and breaks up the asphaltic material and floor planks.

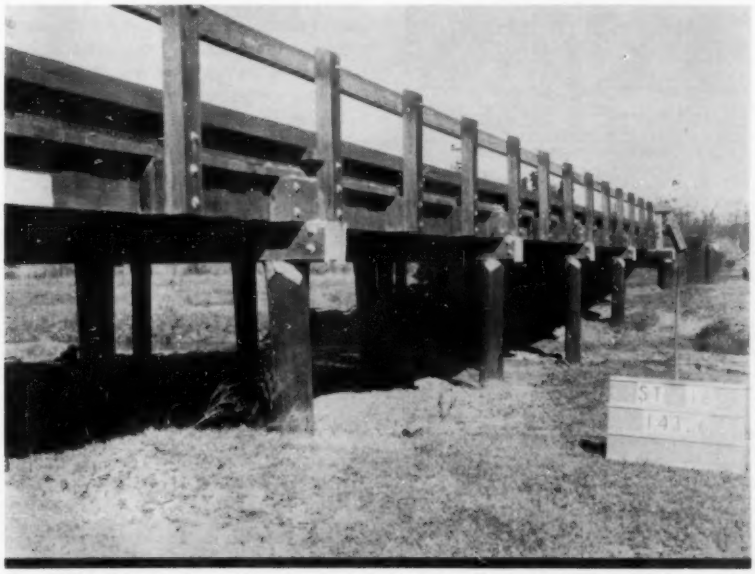
When the decay in piling reaches the danger point, the piles are replaced with new treated timber piling or steel H-beam piling. Some preventive maintenance has been done by applying a coat of tie sealing compound to the surface of the pile when they are about 10 years old. When it becomes impossible to hold the floor planks with spikes and an asphaltic mat, the entire superstructure is replaced with a precast concrete section, or thicker treated timber flooring. When timber joists, broken by excessive loads are replaced, extra joists are often added in order to increase the load capacity. Railing, post and wheel guards are of creosoted timber and the railing is of painted untreated timber. The untreated railing is repainted periodically or replaced when the timber decays.

Approximately 6 percent of the total road maintenance expenditures is for bridge maintenance.

Bridge Numbering

Bridges are numbered numerically according to odometer readings to the nearest tenth of a mile. Zero reading is set at the west end of routes extending in an east and west direction, and at the south end of routes extending in a north and south direction. The bridge number is stenciled on the outer side of the outer girder beam near the abutment and on the right side when approaching from either direction. In this position the stenciled numbers are protected from weather, dust and vandalism. The fact that the numbers cannot be seen by Department employees from their vehicles on the road is considered objectionable by some, because bridges can often be used to orientate other locations. However, the main purpose in numbering bridges is for ready reference and to facilitate record and cost keeping.

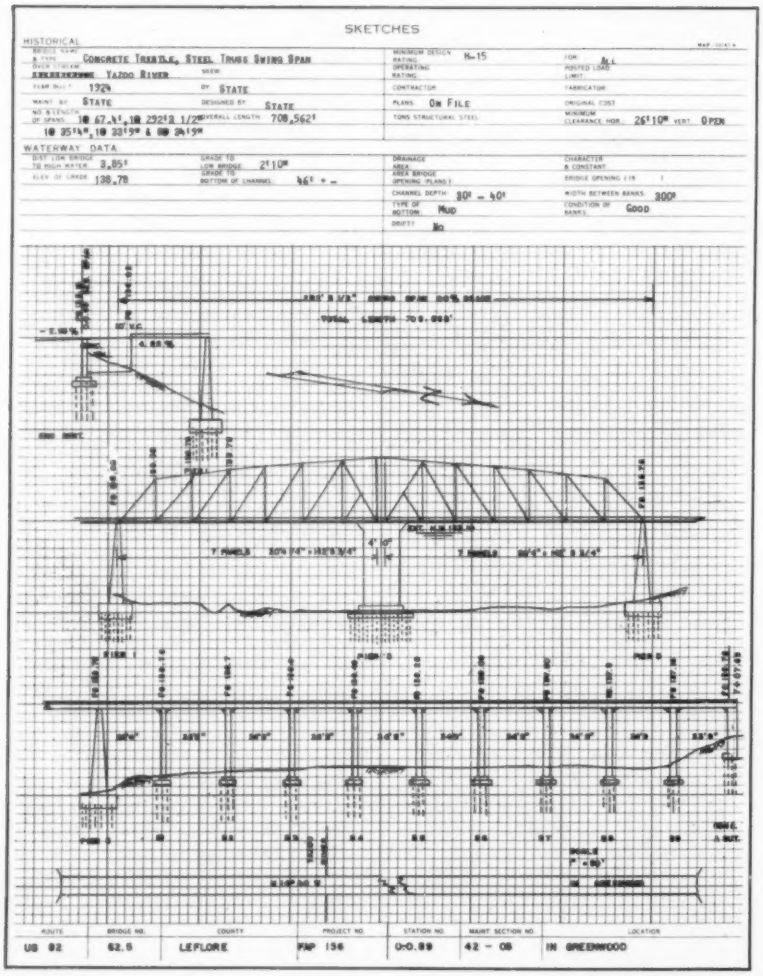
The bridge data files include a separate record for each bridge. Standard forms adopted by the Planning Division and approved by the Bureau of Public Roads are used for keeping this record of bridges. The records include the bridge number, route number, date constructed, detailed description, one or more photographs of the bridge, and a report of the last inspection. When an inspection report indicates defects that call for im-



● **CREOSOTED timber bridge standards call for 4-pile bents, 12" by 12" caps, 14" stringers and 3-in. plank flooring covered with a bituminous mat 2 inches thick.**

● **THIS bridge is of steel I-beam girders on creosoted piling and caps, with concrete deck and concrete railing.**

● **SPALLING of end of concrete girder has occurred due to expansion and contraction. For repair methods see text.**



● **BRIDGE DATA FILE provides sketches as well as standard record forms listing details of superstructure and substructure designs and latest inspection reports.**

mediate repairs, a colored strip or flag is inserted at the bottom edge of the file and left until repairs have been made. This reminder flag is visible when the drawer, holding the particular file, is pulled out of the cabinet.

At almost every Commission monthly meeting more county roads and bridges are accepted and taken over by the State Highway Department for maintenance. New construction necessitates retiring old bridges and placing new ones under maintenance, and the alteration of the length and design of the bridge in maintenance operations also necessitate perpetual changing and correcting of the files in order to keep them up to date. When work on a bridge amounts to additions and betterments, the district furnishes a detailed report to the central office and the changes on the particular bridge are noted on the record.

In addition to the inspections made by the districts' maintenance personnel, one full time bridge inspection crew works out of the state maintenance office. This crew makes at least one detailed inspection of each bridge on the state road system during the calendar year.

With these records it is possible to estimate the extent of replacements that will be required due to deterioration during a future period, or the extent of replacement which should be made due to inadequacy for present or projected traffic conditions. With the file record of the structure it is possible to make immediate plans to meet an emergency condition as when a bridge is washed out by flood waters or is damaged by fire, traffic or other causes. This ready reference also eliminates the possibility of overlooking conditions that require corrections, and affords a record of all changes that could be charged to additions and betterments.

● ● ●

Parking Meter Revenues

Parking meter revenue in Toledo in 1956 totaled $188,805.82, compared with a total of $204,085.15 in 1955. Daily average per meter dropped to $.437 from $.461 in 1955.

AERATOR FOAMING CAN BE CONTROLLED

ANTON E. SPARR, P.E.
Superintendent,
Bay Park Sewage Treatment Works,
East Rockaway, New York

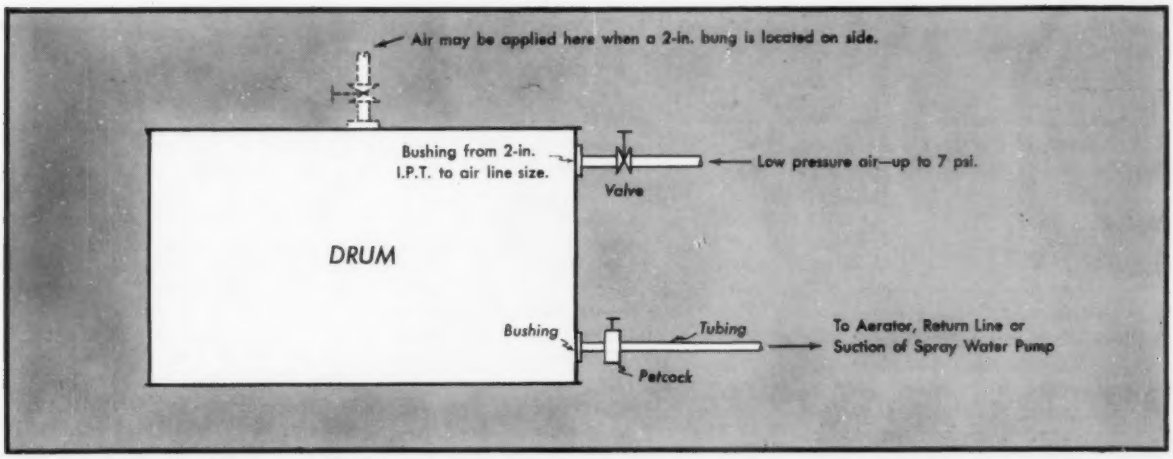
FOAMING—FROTHING—SUDSING are the terms variously used to describe the formation of foam at the surface of diffused air and mechanical aeration tanks. The foam, if uncontrolled, has been known to blanket an aerator to a height of 14 feet. Often the foam blanket has been likened to a beautiful snow scene; on other occasions, dye wastes have imparted brilliant colors such as pink and green. With all this beauty, why should there be so much fuss and fury about foam?

Unfortunately, to the sorrow of many operators, the foam has dirt and grease entrained in it. When the foam bubble bursts, it leaves a deposit of a dirty, greasy material which is difficult to clean. This greasy substance mars the appearance of plant buildings and roads, kills landscaping and makes walks and guard rails dangerously slippery. Obnoxious odors will emanate from this deposit, causing complaints. Unfavorable publicity also results on those occasions when wind picks up the foam and carries it to neighboring homes — as much as a mile away—with the attending grease deposits.

A blanket of foam also interferes with the proper operation of the aerators in two ways. First, the operator cannot make a visual inspection for proper air distribution along the surface of a diffused air aerator. Second, the blanket interferes with the important oxygen absorption from the atmosphere by screening off the latter from the liquor surface. This requires an increase in the blower output to supply the oxygen deficiency. In plants equipped with mechanical aerators, this screening off could be catastrophic because the atmosphere is the major source of oxygen at such installations.

All of the available measures utilized to control foaming effect either a "knockdown" of the foam particles or prevent their formation or both. These measures include raising the suspended solids level in the aerator, the use of water sprays to beat down the foam and the use of defoaming agents.

Many operators have tried raising the suspended solids level, a practice which means the altering of the designer's original considerations by the carrying of very high solids. For example, at Cranston, R.I., the normal level of 1250 ppm was increased to 3000-3500 ppm. In some plants the changing of operations from the original intent has led to happy results in the way of foam control. At others, including the Bay Park Sewage Treatment Works, no change in foaming was noticed, even when the solids level reached 3500 ppm. One result of raising the solids level is an increased air demand; this could be costly when one considers that the power requirements for aeration represents 60 to 70 percent of a conventional diffused air activated sludge plant's total demand. The operator may find that the air requirements for maintaining the higher solids level exceed the plant's blower capacity — the Motherwell (England) plant reached the limit of its blower capacity at 2450 ppm without gaining control of the foam. Exceeding the blower capacity is likely to occur in plants designed for the high rate activated sludge process when a change is made from a low solids to a high solids operation for foam control. High suspended solids in the aerator will



● **A SIMPLE, low-pressure defoamant feeder that maintains a constant rate of flow regardless of liquid level in the drum.**

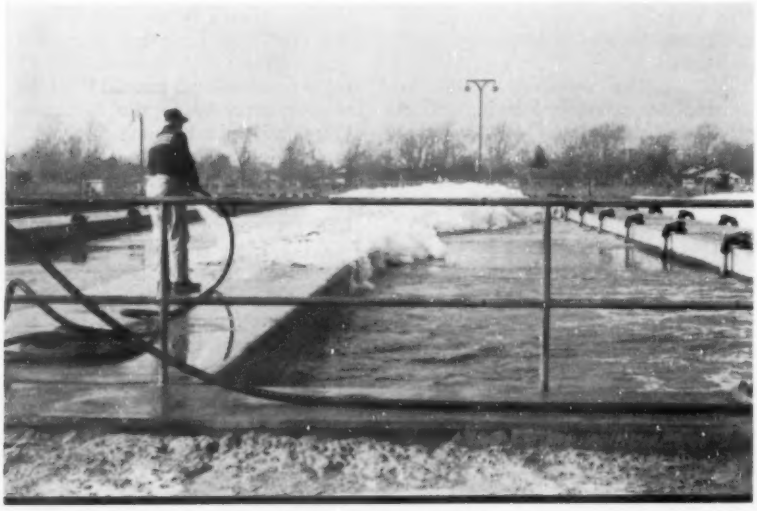
result in a high sludge age and may result in floc disintegration. It is felt that a limited solids adjustment could be made and that this step should be supplemented by the use of a defoamant. Here the various factors involved must be considered for the most economical operation.

Water sprays are helpful but are not completely satisfactory, particularly during periods of low flows when the maximum foaming takes place. During these low flow periods, the sprays supplemented with a defoaming agent have proven to be adequate. The addition of a defoamer is also indicated on those occasions of high flows when the sprays are not effective. The installation costs of an adequate spray system may be prohibitive for the small plants, but, nevertheless, should be given serious consideration.

Using Defoamants

The third foam control measure indicated earlier requires the use of a foam-killing chemical usually called a defoamant or defoamer. Where the formation of foam is present, the addition of an effective defoamant should result in a marked reduction in the volume of foam in the matter of minutes—this rapid reduction is called "knockdown". A quality defoamant will also act upon foam beginning to form at the liquor surface and thus prevent a buildup. Because the formation of foam is a surface phenomenon, a defoamant to be most effective must be able to remain on the surface during much of the aeration period. This means that the defoamant must have a specific gravity lower than that of water and must not be water soluble. The latter characteristic is very important from a cost standpoint. Where a water soluble agent is used, a large quantity of it must be in solution in order that a sufficient amount for effective control can be present at the surface.

Defoamants can be applied in various ways and at various locations. The old standby — the drip method—can be used but has the disadvantage of having a varying discharge as the liquid level in the container changes. Drip cans can be located at the beginning of the aeration tank or at points of excessive foaming. A more satisfactory means, a modification of the drip method, is the application of air from the aerator air header to a closed drum. Here, regardless of the liquid level, the pressure (head) on the petcock will remain nearly constant, assuring a fairly uniform rate of feed unless the petcock is readjusted. This is an inexpensive feeder and it is good for surface application or for discharge into the suction side of a spray system pump. Such a feeder also permits the use of modest runs of tubing. Proportioning feeders permit indoor installations and have the added advantage of being easily and accurately controlled for greater efficiency and economy. These feeders also make it possible to apply the defoamant under pressure: 1) Through long runs of small diameter tubing discharging at salient points; 2) To the return sludge line leading to the aeration tank; or 3) Into the spray system where it is used to supplement the sprays when required.



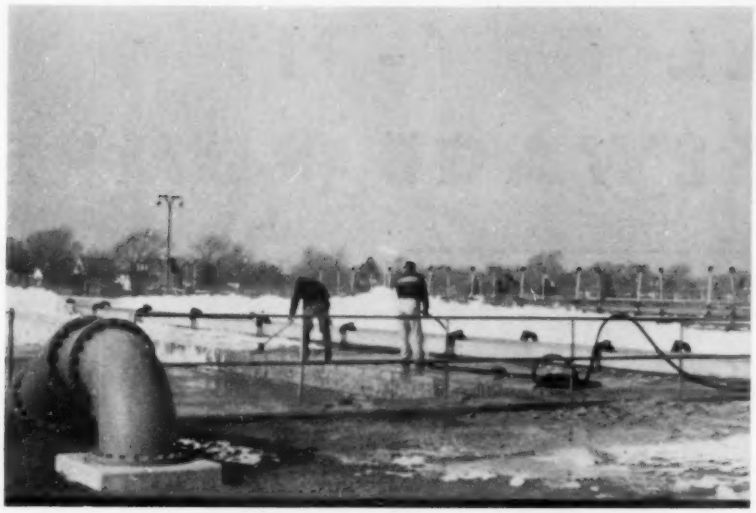
● **GREASE and dirt are entrained in the foam bubbles and when these burst they leave a deposit which is slippery, odorous and is difficult and costly to remove.**

Some plants have had good control from the distribution of the defoamant on the surface at one or more points; others have effected good control where the defoamant was introduced into the return sludge line as has been practiced at the Bay Park plant for several years. The supplementation of the spray system with a defoamant appears to be the most effective and economical arrangement for the larger plants. The use of multiple, independently controlled feeders operated by one motor and reduction unit permits the introduction of the defoamant into any combination up to four aerators or four spray headers.

Defoamant Characteristics

The above indicates that a satisfactory defoamant must have many characteristics. Also, it must be easily applied. The liquid form answers this requirement in that it can be applied with various devices including the inexpensive drip cock and can be readily fed at many points simultaneously. Three other requirements directly indicated from the above are the low specific gravity, the water insolubility, and the good knockdown. (A simple field check for the existence of this knockdown ability can be made by emptying the contents of a 4 to 8-ounce bottle of defoamant into a foaming aerator and watching its action on the foam for a few minutes. A marked decrease in foam volume would indicate a good knockdown. The travel of the defoamant can also be observed by noticing the movement of a defoamed section along the tank.) In addition to these four, experience dictates at least four other requirements: pour point, viscosity, residual effect or persistency, and stability of the formulation.

The pour point is of great importance where the defoamant is set up and/or applied outdoors or fed through long lines of tubing. Its importance depends not only upon the normal low temperatures reached in any particular area but also on the abnormal lows because the atmospheric temperature, which exerts no apparent deterrent effect on foam formation, adversely affects the viscosity. At 10°F, a high pour point liquid will not flow from a drip can nor can it be pumped. Under the same low temperature (10°F.) it is possible that



● **BLANKET of foam interferes with plant operation by preventing operators from checking air distribution and screening off air usually absorbed at water surface.**

a defoamer having a pour point of 0°F. or less may flow if its viscosity is relatively low at this temperature.

This brings up the question of viscosity. There are two factors associated with it that must be given serious thought. The first is the degree; a low viscosity liquid can be controlled more easily than a high, particularly where small heads are involved such as in a drip can. The second is the relative change in viscosity for a change in temperature. The smaller the change through the operating range of temperature, the more it approaches the desired unchanging viscosity resulting in a constant feed for any fixed setting and head. This quality also makes outdoor storage possible without the necessity of thawing out prior to use. Unfortunately the viscosity of many of the defoaming agents now in use increases markedly as the temperature drops below the freezing point.

In addition to a good initial knockdown and foam destruction capacity, a defoamant for the most economical usage must have the capacity to maintain its defoaming character throughout the length of the aeration tank and not spend itself shortly after its introduction. Some of the defoamants tested had this persistency or residual effect incorporated in the formulation to such an extent that effective control existed in both the aerated (mixed) liquor channel and the return sludge channel. The latter may come as a surprise to many but is readily explained. Solids or floc particles come in contact with the defoamant during the aeration period. During the final sedimentation, much of this defoamant, which has adhered to these particles, will remain with them and be carried to the return sludge channel. Because the concentration of solids is very high in this channel, there usually is a sufficient quantity of defoamant present to effect control. The adherence of the defoamant to the solids is also indicated by the regularity with which small oil slicks keep appearing throughout the final tank surface. These are due to the minute particles of defoamant freeing themselves from the solids and "popping" to the surface.

The remaining desirable characteristic is the stability of the formulation and material. A stable formulation assures a uniform distribution of the additives in the defoamant at all times during its application and insures that these additives and other materials will not settle out during storage.

Dosage

In the dosages now generally used —0.5 to 2.0 ppm—the BOD and the toxic effect of a defoamant are usually not significant. However, it is well to make the laboratory determinations in order to know what effect these two characteristics could have.

Summary: Foam or Froth in aeration tanks which can mar the appearances of buildings, roads, walks, etc., create dangerous slippery conditions, cause obnoxious odors and create adverse publicity, can be controlled by several means. These are: 1) Raise the suspended solids level carried in the aerator; 2) use water sprays to kill the foam; 3) use defoamants to kill the foam; and 4) utilize any combination of two of the above or possibly all three.

An efficient defoamant should possess the following desirable characteristics: Be a liquid; have good foam knockdown and residual effect or persistency of this knockdown quality; have lower specific gravity than water, constant or nearly constant viscosity over the range of the outdoor temperatures encountered, water insolubility, stable formulation, low pour point and low performance cost.

Pavers in Tandem Place 28-Ft. Roadway

● **WORKING in tandem on the Massachusetts Cross-State Turnpike, these two Blaw-Knox PF-90 pavers put down a total of 125,000 tons of asphalt, with no replacements to the screeds. The machine in the background is set to place a 16-foot wide section of roadway at one pass. The second PF-90, in the foreground, is set at 12 feet.**

VERTICAL DRY-PIT SEWAGE PUMPS

R. H. DEURER,
Worthington Corporation

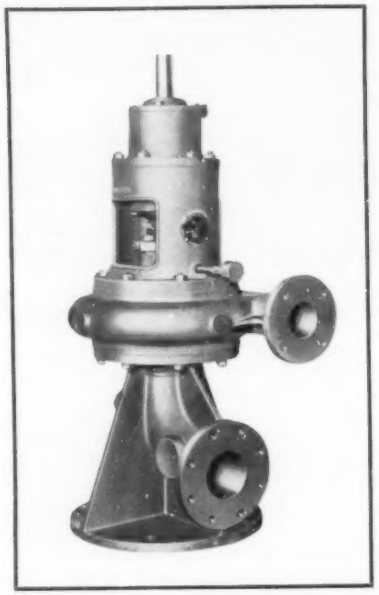
A GOAL in sewage lift station design is an arrangement which is both functional and economical. Vertical shaft, dry-pit sewage pump installations have both these advantages. A station of this type consists of a dry pump operating room located next to a wet-well. The drivers, motors and/or engines are placed above the pumps and are connected by intermediate shafting. However, "close coupled" units can be used, with the motors supported directly on or above the pumps.

The accepted practice is to use end suction, side discharge sewage pumps. Accordingly, vertical shaft sewage pumps are bottom suction, through a straight suction nozzle or long radius elbow. Both the suction and discharge nozzle can usually be rotated, allowing for the most suitable piping arrangement.

These vertical pumps may be supported in two ways. One is by feet on the casing or suction nozzle; the other is by a base cast integrally with the suction elbow. Both of these methods reduce floor area to actual pump casing dimensions. In most cases, gravity is used to collect sewage and, because of this, the wet well is usually rather deep in the ground. A reduction in building dimensions is reflected in lower first costs for both excavation and construction.

In addition, the use of vertical pumps provides the advantage of protecting drivers and their accessories. Driver floors can be free of piping and valves and high voltage equipment is not exposed to stuffing box leakage or wash down water. Expensive electrical equipment is protected against flooding, the drivers are isolated from the gas-hazardous atmosphere of the wet-well, eliminating the necessity for explosion-proof electrical equipment.

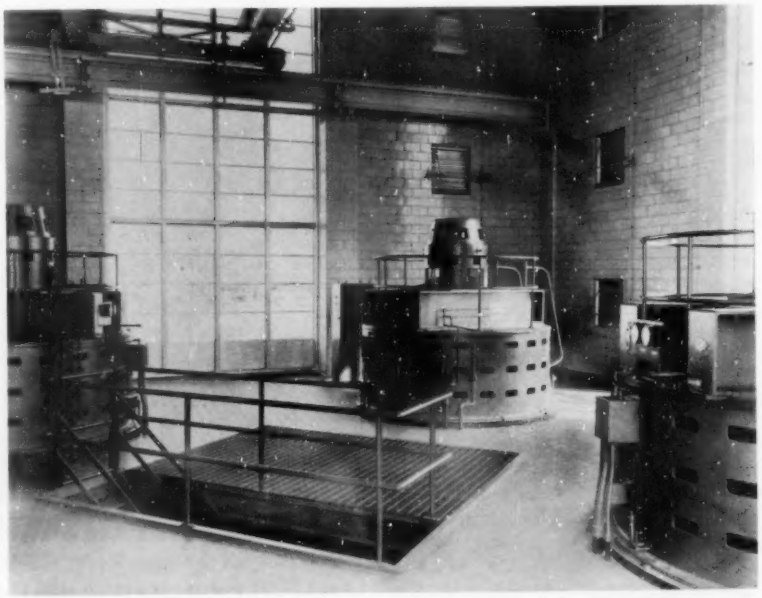
On vertical shaft installations, when the driver horsepower is below approximately 250, flexible needle-bearing intermediate shafting is used. Installations requiring spans greater than about eight feet will use two or more sections of shafting with intermediate guide bearings. These flexible connections, with splined joints, minimize installation and alinement time. When the driver horsepower exceeds 250, solid steel intermediate shafting is normally used. Depending on pump bearing design, either piloted flexible or rigid couplings are used. When the pump has its own thrust bearing, flexible couplings with floating sections of shaft are used, and when this thrust is carried by the motor bearings, solid or rigid couplings are used.



● **TYPICAL vertical shaft dry-pit sewage pump with suction base elbow.**

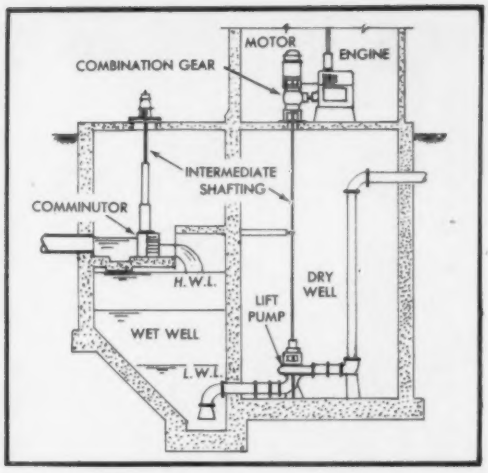
Sewage flow is continuous and is not affected by power failures; in fact, storm flows are considerably greater than normal rates. For this reason stand-by units with an auxiliary power supply are required. In some cases, particularly in larger plants, engine driven generators supply emergency electrical power; but vertical dry pit pumps can be arranged easily for combination motor and engine drive. This arrangement obviates the need for separate engine driven stand-by pumps.

Proper orientation of wet-well sewage levels in respect to pump setting results in constantly flooded suction conditions, eliminating the necessity for priming apparatus. Suction piping is simplified and the discharge piping also can be made simple. Because static heads encountered in pumping sewage are



● **AT DETROIT'S Blue Hills Station, three vertical synchronous motors supply a total of 9,000 hp to drive 72-in. Worthington vertical dry-pit pumps on lower floor.**

● **VERTICAL sewage pumps of 64 mgd total capacity are installed at Bridegport, Conn., West Side Plant. Motors are on floor above.**



● **TYPICAL sewage lift station with wet well adjacent to pump room and motors on upper floor.**

usually relatively low, simplified suction and discharge piping is essential for efficient operation.

The most important features in sewage pump design are freedom from clogging and reliable operation. Since it is dfficult to eliminate clogging completely, easy access to the pump interior is important. Vertical dry pit pumps are constructed so that they can be opened without disturbing the driver or suction and discharge piping. By removing or swinging to one side a short section of intermediate shaft immediately above the pump, the entire rotating element can be withdrawn. Since neither the casing nor the driver have to be moved, the weights handled during this operation are reduced.

Although vertical shaft wet pit installations, where the pump is submerged in the wet well, have the same advantage of reduced space requirements, they do not have the advantage of simplified maintenance. In order to get to the rotating assembly, the pump assembly must be withdrawn from the wet well, and most times the driver has to be removed before the pump can be withdrawn. Consequently, wet pump installations are recommended only when no other arrangement is feasible.

In addition to raw sewage pumps, other equipment installed in or near the wet well is available with vertical extended shaft construction. For instance, when comminutors are installed in the wet well, they are usually isolated from their motors by flexible intermediate shafting. The comminutor has its own built-in floor protection, and the motor is located away from dangers of flooding or explosive gases.

New Reservoirs

AID INDUSTRIAL EXPANSION

A. R. MacPHERSON

TWO LARGE water reservoirs on its Green River gravity line were recently constructed by the city of Tacoma, Wash. as a final step in a program for rebuilding and modernizing its water system. Begun in 1948, the program involving the numerous projects large and small, gives Tacoma a well planned water distribution system. Tacoma now has 8 reservoirs in use to serve a population of 156,000 people and over 300 industries.

● **NEW 100-MG McMillan Reservoir from the air. The older 50-MG storage at left will be continued in use.**

● **LOCATION in a residential area restricted the size of the Portland Avenue reservoir. With a capacity of 50 million gallons, this serves the industrial area.**

As a result of the availability of almost unlimited water resources in the rainy Northwest area, Tacoma has one of the largest per capita consumption of water among American cities. Average consumption totals 54 mgd, with a peak of 65 mgd in summer. Since many miles of wooden mains have been replaced with iron pipe and water meters installed in all homes, the use of water during summer was considerably reduced with a resultant daily saving of many millions of gallons.

The Green River gravity pipe line, 40 miles in length and with an estimated capacity of 67 mgd supplies most of the city's water demands. An efficient pumping system of numerous wells located in the South Tacoma area supplements the Green River supply and is employed during the summer to meet the peak demand and emergencies.

The largest of the two new reservoirs is located at McMillin, 20 miles east of Tacoma, and has a rated capacity of 100 million gallons. The site elevation of 590 feet above sea-level allowed gravity flow to the city. The old reservoir of 50 million gallons capacity is located on the same site on a hill directly above the nearby Puyallup River. No filtration is used but chlorine is added to the water when it becomes turbid from heavy rains on the watersheds. Should the water become too full of sediment for human use it will be diverted into the Puyallup river until the Green River clears. The city will then fall back on its storage reservoirs for water plus the South Tacoma well system.

Main purpose for building the new basin was to insure a good reserve of water at high pressure for future needs of the city with its steadily growing population and increasing number of new industries. It was completed in record time, actually 3 years ahead of schedule. The city of Seattle and the Federal government are constructing a dam on the Green River a short distance above the Tacoma water intake to control river floods in low land areas adjacent to Seattle. It was believed dam construction would endanger the sanitary conditions of Tacoma's water supply, so immediate building of the reservoir was deemed imperative to give Tacoma protection from water pollution.

The new basin is oval in shape, 1,100 ft. by 700 ft. It has a usable water depth 20 ft. Approximately 16,000 cu. yd. of concrete went into its construction. The Sherf Bros. & Sandkay Co., of Ephrata, Wash., were the contractors. The cost was $1.326 million of which approximately $256,000 was Federal funds.

The second new reservoir, just completed, is located within Tacoma proper on a hill above Portland avenue in the east side area. Of rectangular design with a 50 million gallon capacity, the storage basin will serve primarily the tideflats industrial area which in years past was served from the smaller Hood street reservoir. New industries in Tacoma created a greater demand for water in the tideflats district where most of the industries are located. Consumption of water for industrial use runs from 30 to 34 mgd, with one large paper mill alone using 19 to 21 mgd. This need was partly met in 1951 when the city laid an 8,000-ft., 36-in. line across the tideflats. The new reservoir on the hill overlooking the tideflats, because of its good elevation supplies the required pressure. The Tacoma Port Commission is presently acquiring large new tracts of land east of the old tideflats area which will be designed and promoted for many future industrial sites. The potential water demands of these new industries must be planned for long in advance.

The particular site and size of the east side reservoir was decided by the city's ownership of the land, its nearness to the tideflats and the Green River pipeline and its requisite elevation which eliminated pumping. Its size was restricted, however, by its location in a well populated residential area which would require considerable condemnation of home properties for a larger basin.

Construction was handled by Ostruske - Murphy, Inc., Tacoma contractors at an approximate cost of $820,000. With a usable water depth of 20 feet, the reservoir has a maximum length of 945 ft. and width of 400 ft. Some 10,000 cu. yd. of concrete was used poured to an average thickness of 6 ins.

For weeks the contractors struggled with severe drainage problems following unusually heavy fall rains resulting in a 6 months' delay of scheduled completion time. The city granted several time extensions as more wet weather slowed the pouring of concrete.

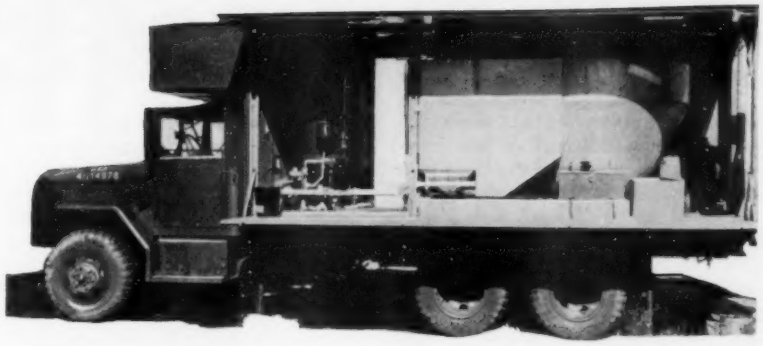
Plans for both reservoirs were formulated under W. A. Kunigk, long-time former Superintendent of the Tacoma Water Dept. Since his retirement from active service he has been succeeded by J. A. Kuele, who carried the two projects to completion. Serving under him as city resident engineer of construction was George Hopkins, assisted by project engineer, Earl Meyer.

• • •

St. Louis to Get Revenue from Salvaging Cans

A minimum of $1500 per month is guaranteed St. Louis, Mo., for salvage rights to tin cans that have passed through the city incinerators. The bid price was $4.875 per gross ton, with the minimum monthly payment as stated above. It is reported that after a reclaiming process the material is utilized as a precipitating agent in the reduction of copper ore.

Courtesy U. S. Army



● **MOBILE water purification unit consists of filter and chlorinating equipment on a motor truck. This unit from Fort Belvoir was used for treating water in the flooded Stroudsburg, Pa., area.**

PUBLIC WORKS *Engineers in Civil Defense*

ARNOLD S. NESHEIM
Director,
Emergency Restoration Division,
Engineering Office,
Federal Civil Defense Administration

THE ROLE of the public works engineer in a major catastrophe —caused either by the forces of nature or by enemy attack—cannot be over-emphasized. In any such crisis we must be ready to deal with widespread destruction, both in human life and physical facilities such as buildings, highways, public utilities and communications. Our engineers compose a group with the knowledge with which to plan and direct restoration of destroyed and damaged facilities and to avert further loss of life.

It is of little consequence into which category of engineering you may fall. During a national emergency, the electrical engineer may (and probably will) be called on to assist or direct construction of temporary shelters, roads and utilities. The civil engineer may be needed in the construction of emergency heating plants. The mechanical engineer may have to divert his experience and equipment to road repair—dependent entirely upon the need and the location of the moment. There could be little clear-cut division of specialization in such a national emergency, thus all engineers should familiarize themselves with the basic concepts of civil defense and the problems involved.

Precisely, what is civil defense? Can it be defined tersely? What does it mean in the pattern of our American way of life? Where do we stand on it today?

Civil defense simply means survival. Modern civil defense is a workable and sensible means of preserving and safeguarding lives and the spiritual, intellectual and material resources which have made this nation great. It is a task which begins with the individual, encompasses the family and extends to the neighborhood, municipality, state and nation. It is much more than preparing for a nuclear war we pray never will materialize. It is becoming the modern way of American life, for basically it teaches the individual how to protect himself from danger and how to help others to survive.

Courtesy Federal Civil Defense Administration

● **CIVIL defense pumps at work in the 1955 California floods. They are being used here for dewatering flooded areas and not for safeguarding emergency supplies.**

Only a few years ago, our cities and communities were more isolated from one another because of inadequate transportation and communication facilities. An emergency in one area naturally affected other areas, but in a much smaller degree than we may experience today. In this age of specialization in business and industry, few of our manufacturing centers are totally independent of others. What affects one area exerts a direct impact on other areas. The same may be said of our communities.

Thus, a disaster in California is felt in New York; a crisis in Oregon affects the people in Florida.

Since 1945 this nation and others have been devising and building increasingly more powerful nuclear weapons. Today, the destructive capability of the hydrogen bomb surpasses the imagination. As long as a potential enemy of the United States exists, we face the constant threat of nuclear attack, either by long-range bombers or by intercontinental ballistic missiles which are now under development.

Before 1954, many of our communities had some type of civil defense program which provided for partial evacuation of a nuclear bomb target area, but depended primarily on the concept that an adequate

shelter could be provided for many people based on what we knew of the power of the atomic bomb at the time. By 1954, however, our tests with hydrogen weapons in the Pacific had unveiled not only the world's most destructive war machine, but had opened the door to a new deadly menace -- radioactive fallout.

When an H-bomb explodes near the ground its blast pulverizes large quantities of earth and sucks the tiny particles up into its cloud. Here the dust becomes contaminated with radioactivity produced by the bomb. This deadly dust is scattered through the atmosphere by winds and gradually falls back to earth, perhaps hundreds of miles from the actual blast area. This is fallout—the silent, invisible peril of the nuclear age. If heavy enough in a given area and if people are exposed to it long enough without protection, the result of fallout is illness or death.

Thus it is obvious that we either must evacuate our populations from target areas and sections subjected to heavy fallout, or we must provide shelters adequate for protection against the bomb blast and its after effects.

With an eye on the intercontinental ballistic missile of the future, we are now engaged in a study of shelters, seeking possible ways to build shelters strong enough and large enough to protect our people. We are faced with a problem of balancing shelter against evacuation in the overall survival plan of each target area, and during such a possible construction program we still would have to provide for the public safety in the best possible way. Therefore, we cannot ignore the concept of evacuation, either during the shelter construction period, or after the shelters are completed.

This, briefly, is the task we face today. Civil defense can be summed up in this way: First, we must protect our population from attack and care for them after attack until they can take care of themselves; second, we must rebuild and restore our productive capacity after attack with the utmost speed.

Our engineering services in civil defense, which includes the contracting industry, must be prepared to expedite traffic movement by removing obstacles on evacuation routes; to make adjustments in distributor and access routes as required by post-attack conditions; to clear debris and wreckage over those routes; to make emergency repairs to, and temporary replacement of, damaged community facilities — communications, hospitals, transportation and other services.

In the overall civil defense organization (down to the local level) our engineering services—like other professional civil defense services—are built upon existing civilian groups and public departments and agencies within each potential target area. Each segment should be assigned a civil defense responsibility that is most closely allied with its normal function.

Utilities and industries in the categories listed below, plus local public works engineers, should be organized and trained to cope with damage caused by enemy attack:

1. Water supply and distribution.
2. Sewage treatment and collection.
3. Artificial and natural gas.
4. Electric power and distribution.
5. Communications facilities.
6. Street, road and bridge departments.
7. Maintenance and construction divisions of railroads and street railway and bus companies.

Because of their training and experience, the nation's engineers can provide a highly essential service to this country in the post-attack period, if America ever undergoes enemy action. A few ways in which they will be needed, include:

1. Estimating manpower and equipment requirements for debris clearance on road network, emergency replacement and repair of utilities, and the reconditioning of buildings needed in civil defense operations.

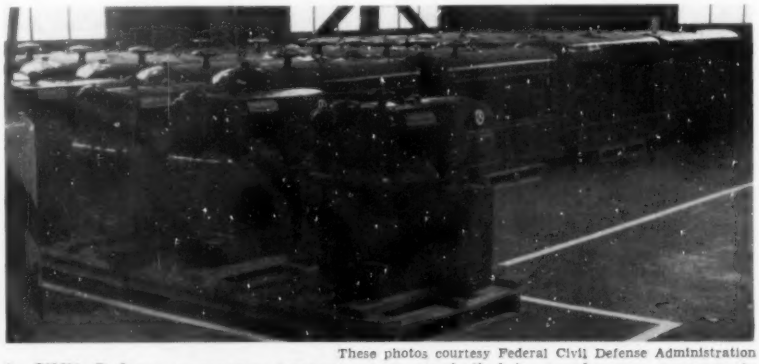
2. Estimating amount of building space available through minor repairs.

3. Estimating remaining capabilities of water, sewer, gas and electric utilities.

4. Directing emergency repair and replacement of community facilities including gas, electric, water, and sewerage utilities, housing and clearance of debris.

5. Construction of emergency housing and utilities for evacuees.

After these estimates and temporary repairs have been made at the local level, our engineers must be prepared to throw their skills into the almost superhuman job of restoring the nation's productive capacity. Without full production, we cannot hope to win after an attack. We must be prepared to rebuild quickly, no matter how serious the damage.



These photos courtesy Federal Civil Defense Administration

● **CIVIL Defense emergency generators are stockpiled in warehouses at strategic locations throughout the country. Using them properly would be a job for engineers.**

● **WATER filtration units are stored by FCDA and are available for emergencies.**

EFFECTIVE
ROADWAY LIGHTING PRACTICE

R. M. SWETLAND

Illuminating Engineer,

Outdoor Lighting Department,

General Electric Company,

Hendersonville, North Carolina

AMERICA'S RAPIDLY increasing population, coupled with constantly expanding roadway mileage and improved transportation facilities, imposes a correspondingly greater need for better protective visibility at night—for both vehicular and pedestrian traffic.

In attempting to review the present status of roadway lighting in this country, brief emphasis will be given to such factors as (a) the need for and benefits from adequate roadway illumination; (b) basic objectives in building and applying roadway lighting equipment; (c) guides for those dealing with roadway illumination; (d) available roadway lighting tools; (e) examples of well-lighted roadways; and (f) other pertinent comments and data.

While the term *roadway* includes both urban streets and interurban highways, much of this discussion will be focused on our highway lighting problems.

The past few years have seen practically a universal recognition of the need for more effective roadway visibility as a proven safeguard against traffic accidents, fatalities and crime. To cite only a few endorsements and statistics: J. Edgar Hoover, Chief of our F.B.I., "heartily advocates improved roadway lighting as an effective deterrent to crime and a safeguard to traffic flow." From the National Safety Council come these statistics: Total 1954 motor vehicle fatalities—36,000; in urban areas—9,000; in rural areas —27,000. Approximately 55 percent of the rural accidents occurred at night. With adequate visibility, 50 percent of these night deaths—over 7,000—could have been prevented. Preventive street lighting costs far less than the total economic loss resulting from unprotected night traffic. As one public official states, "We pay for good street lighting, whether we have it or not". Another N.S.C. statement is: "There is no doubt that night driving is considerably more hazardous than day driving, and the hazard is greater in rural areas than in cities."

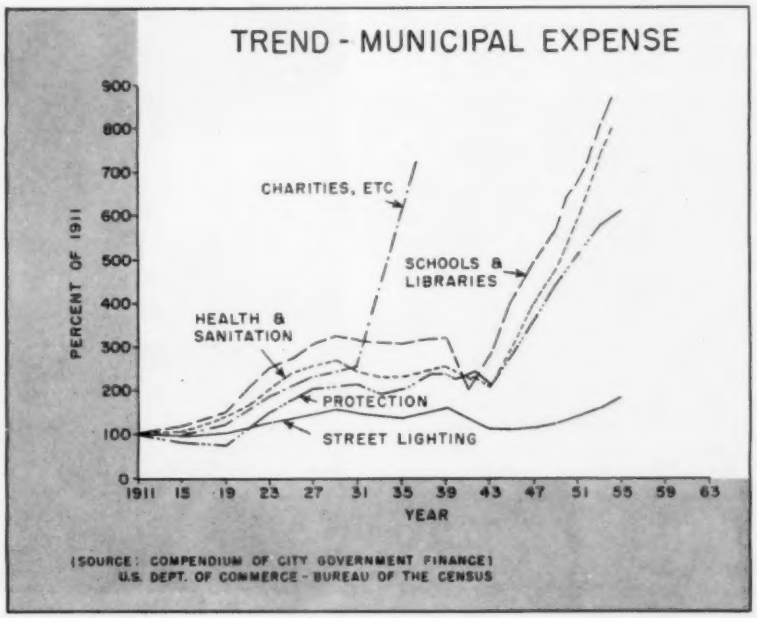
It is disconcerting to realize that (a) of the lighted roadways in this country, less than 10 percent meet recommended IES illumination levels, and (b) less than 5 percent of our inter-urban highways are lighted. Our investment in street lighting lags behind other municipal expenditures. While we now invest between $1.25 and $1.50 annually per capita for roadway illumination, the needed amount lies between $2.50 and $4.00 annually, if night traffic flow on our primary urban and inter-urban roadways is to be safe and comfortable.

A brief summary of the chief benefits of adequate roadway illumination would include: 1) Traffic safety; 2) traffic comfort and convenience; 3) crime deterrent; 4) retail trade stimulation; 5) enhancement of property values; and 6) promotion of civic pride, advertising value, and attraction of desirable residents.

Basic Objectives

Irrespective of the type of roadway under consideration, whether inter-urban highways or urban traffic streets, "Maximum Visibility (with comfort) per Dollar of Investment" is the primary goal to be achieved. It is not the quantity of light, in foot-candles on the pavement, but, rather, all of the factors contributing to effective and comfortable seeing, which are of prime importance. Three chief ingredients in effective roadway seeing are 1) adequate pavement brightness, of satisfactory uniformity, and 2) effective object and obstacle brightness, which are positive factors; and 3) substractive luminaire glare, which is a negative factor.

Thus, in every properly engineered roadway lighting project, the first two of these factors should be emphasized; with a minimizing of



● **EXPENDITURES for city street lighting have not increased proportionately.**

● **THIS photograph illustrates "seeing by silhouette" which accounts for some 75 percent of how we see at night on the average city street or rural highway.**

the negative glare factor. A photo herewith illustrates seeing by silhouette, which accounts for some 75 percent of "how we see" on the average street and highway. The subtractive effect of glare interference, caused by luminaire brightness at a mounting height that is too low is shown also.

On pronounced grades the vertical axis of the luminaire should be mounted perpendicular to the roadway to avoid undue luminaire brightness and glare to traffic flowing uphill.

Lighting equipment manufacturers and users can cooperate in achieving "most effective seeing per dollar", by: 1) Improved pavement reflectance, using lighter colored surfaces; 2) improved uniformity of pavement brightness, proper luminaire design and correct spacing; 3) reduced luminaire brightness; 4) use of recommended luminaire mounting heights; 5) adoption of proper luminaire positioning, in relation to vehicular pavement; and 6) use of light sources which give true color appearance of objects.

Guides for Lighting Problems: A reliable source of information for those dealing with roadway lighting problems is *American Standard Practice for Street and Highway Lighting*, issued by the IES Street and Highway Lighting Association and approved by the American Standards Association. Copies of this guide are available at IES Headquarters, 1860 Broadway, New York City. As a general guide, the tables accompanying this article may be used. Table 1 gives tabulated recommendations of footcandles advised for various urban and inter-urban streets; while Table 2 shows the recommended luminaire mounting heights, for various luminaire and lamp sizes, to assure maximum visibility.

Improved Tools

Substantial progress has been made during the past 20 years in more efficient light sources, better luminaire design for controlling and directing this light and improved transformer and switching devices for roadway lighting circuits.

Lamps and Light Sources: Disregarding the very early whale oil, kerosene and gas street lights, more recent developments have seen the old carbon filament lamp of 6 to 10 lumens per watt superseded by the mercury and fluorescent lamps of 40 to 55 lumens per watt. Also, there has been a marked decrease in the cost per unit of generated light.

Luminaires for Light Control: Similarly, there has been a marked improvement in the design of luminaire optical systems surrounding these light sources, assuring most effective light control and direction for maximum seeing—but not necessarily maximum quantity of light in footcandles on the pavement. These improvements encompass the complete range of filament, mercury and fluorescent luminaires.

The earlier type of fixture with an exposed lamp and a flat, or radial wave, reflector directed only about 15 percent of the generated light downward over a typical pavement, and in a relatively inefficient pattern. A recent design of luminaire for mercury lamp operation, directs from 40 to 50 percent of the generated light over the pavement area, plus assuring advantageous light control characteristics.

The latest addition to the roadway luminaire family, the elongated fluorescent unit, may set a standard

● **SUBSTRACTIVE effect of glare interference is shown in this picture. Such interference is generally caused by luminaire brightness at a mounting that is too low.**

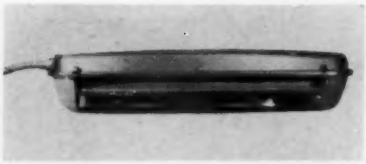
Table 1—Current Recommended Average Horizontal Footcandles

(Lumens per Square Foot)

Pedestrian Traffic	*Vehicular Traffic Classification*			
	Very Light	*Light*	*Medium*	*Heavy to Heaviest*
	(Under 150)	(150-500)	(500-1200)	(1200 up)
Heavy	*	0.8	1.0	1.2
Medium	*	0.6	0.8	1.0
Light or None**	0.2	0.4	0.6	0.8

*This condition is unusual, but if it should occur, the footcandle figures appearing in the column to the right may be used.

**Lighted highways and expressways at grade should have illumination similar to that on urban streets with comparable traffic flow, either vehicular or pedestrian.

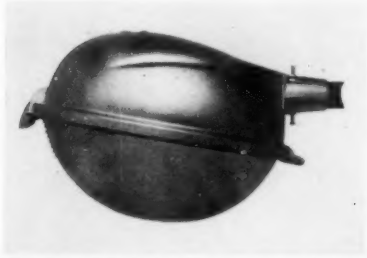


● **FOUR-lamp fluorescent unit six ft. long gives a very good driver visibility.**

of excellence in terms of maximum driver visibility and comfort. A photo herewith illustrates a four-lamp, six-foot unit in this category; larger and smaller luminaires are available. The inherent primary advantages of these fluorescent luminaires are: Low brightness of the luminaire, minimizing glare interference with seeing; more uniform pavement brightness areas, improving silhouette seeing; and true color appearance of objects, when the cool white type of lamp is used.

Circuit Equipment: Progress in circuit equipment has kept pace with lamp and luminaire improvements. For instance, earlier constant current series regulating transformers of the coil-latched-apart design, switched manually by plug-switch panels, have been supplanted by more efficient designs in both oil cooled and air cooled types automatically switched by time-clock or photo-relay actuated control circuits. Such substation-type constant current regulating transformers incorporate necessary control and protective devices in one assembled unit.

Low voltage multiple roadway lighting circuits are proving to be economical and advantageous in numerous instances; their use is being accelerated by improvements in multiple relays, lamp - group

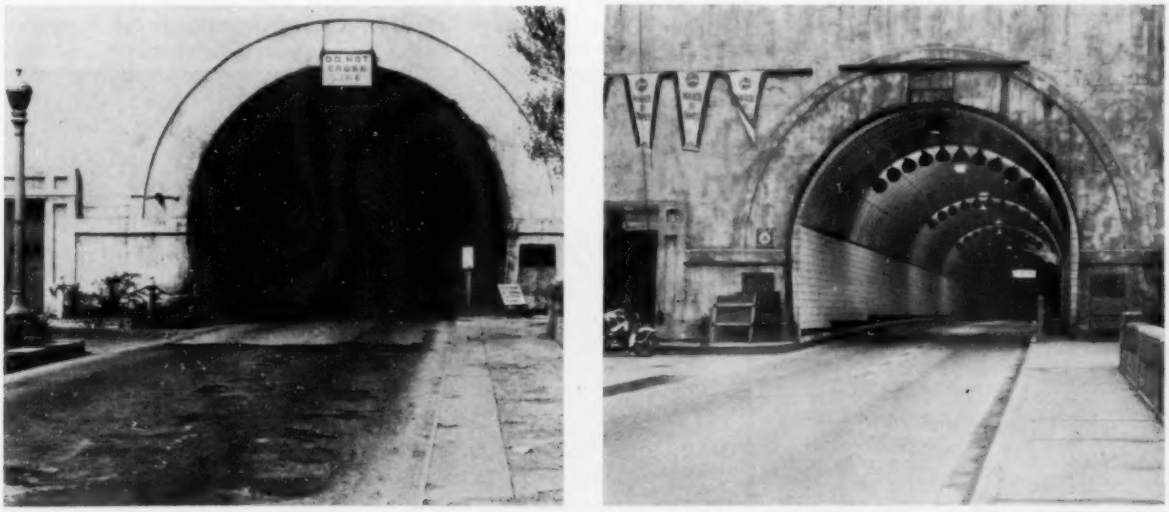


● **RECENT design for mercury lamps directs 40-50 percent light to street.**

Table 2—Luminaire Mounting Heights

Approx. Lamp Size	*Distribution Type*			
Lumens	*Type I*	*Type II*	*Type III*	*Type IV & V*
2,500	25 ft.	20 ft.	20 ft.	20 ft.
4,000	25 ft.	25 ft.	25 ft.	25 ft.
6,000	25 ft.	25 ft.	25 ft.	25 ft.
10,000	.....	25-30 ft.*	25-30 ft.*	25 ft.
15,000	.....	30 ft.	25-30 ft.*	25-30 ft.*
20,000-25,000	.....	30 ft.	30 ft.	25-30 ft.*

*The lower mountings are permissible on streets where the brightness contrast between the luminaires and their background is relatively low.



● **BEFORE AND AFTER treatment of a tunnel entrance to combat daylight outside. Ceiling height and one-way traffic permitted use of floodlights on a 200-foot section. Light intensity graduates downward from 75 footcandles at the entrance.**

● **POSITIONING of luminaires around outside of roadway curve assures maximum pavement brightness uniformity and a minimum of luminaire brightness interference.**

The American Standard Practice for Street and Highway Lighting recognizes this relation between pavement reflectance and visibility by stating, "When reflectance is unusually high (20 percent or more) the recommended values of average footcandles on the roadway may be decreased 25 percent."

Increasing Interest and Action

The Connecticut State Highway Department is planning to light a 50-mile continuous stretch of the new Throughway traversing a thickly-populated area necessitating a succession of interchange areas. Furthermore, this highway department has installed a one-mile demonstration section of two types of light sources to evaluate visibility and comfort before deciding on the preferred lighting system.

switches and photoelectric control devices.

Lighting for Expressways

The current Interstate Highway program has placed a special emphasis on the need for adequate expressway lighting. The cost of such a lighting program may be analyzed as follows: Assume a divided throughway, with two lanes and a parking berm on either side of a narrow median strip having a total width of about 70 feet. Assume metal poles; 400-watt, E-1 mercury lamps in refractor-type luminaires; underground circuits; 45 luminaires per mile; 0.8 to 0.9 footcandle average maintained. Average initial installed cost per mile would approximate $30,000 to $40,000 and annual operation $4500 to $5500 per mile, including the cost of equipment amortization.

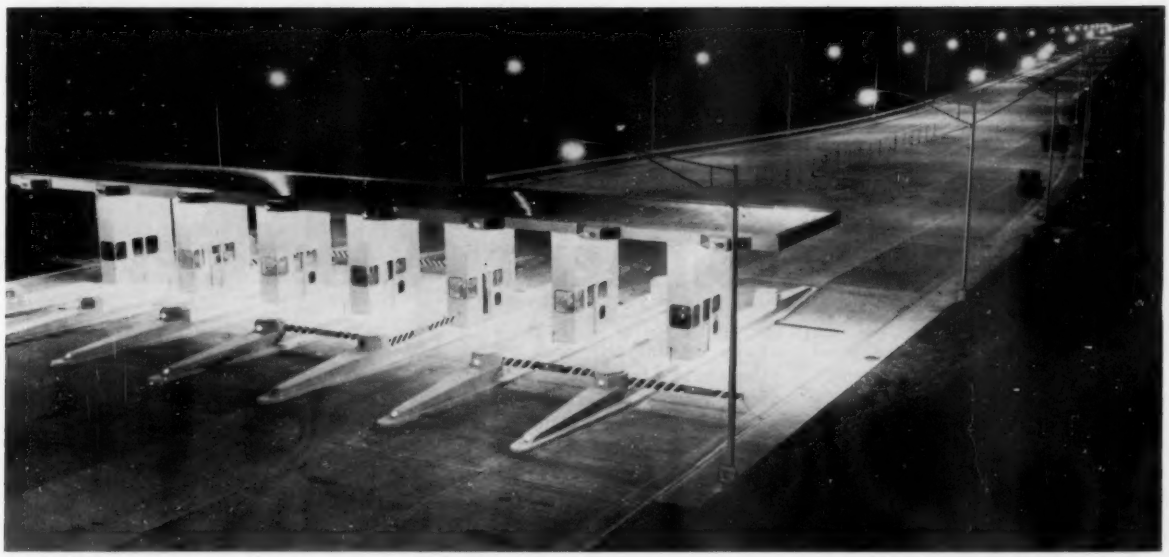
Thus, for only about 3 percent of the total construction cost, the highway can be rendered safe and comfortable during the hours of darkness increasing its capacity and equalizing the traffic flow over the whole 24-hour period.

The use of wood poles and overhead circuits, plus a possible slight reduction in the illumination level for secondary highways, will substantially lower the above-cited cost.

Color of Roadway Surfaces: Strictly from the standpoint of maximum protective visibility per dollar of cost a lighter colored surface, having a 20 to 30 percent light reflectance, gives a higher return in protective seeing per dollar of system cost than does a dark surface, having some 6 to 10 percent reflectance.

● **VISIBILITY is excellent along this section of Edens Parkway, near Chicago. Lamps are 400-watt mercury, in modern refractor type luminaires, mounted at 30 ft. height, with poles staggered at 110 ft. Initial intensity is 1.3 ft.-candles.**

● **SHIELDED continuous line of fluorescent lights give effective lighting on Shasta Dam roadway. Upward of 3 ft.-candles are provided on pavement and sidewalk areas.**



● **TOLL PLAZA lighting. This is at the Delaware Water Gap looking toward New Jersey. The 400-watt mercury lamps provide 1.5 to 2.0 ft.-candles. Wider toll plazas often justify the use of 1000-watt mercury or comparable sized fluorescent lamps.**

The state of New Jersey has long been in the forefront in appropriating state funds for highway illumination. Now upwards of $800,000 annually is invested in maintaining completely, or in part, over 20,000 highway lighting units.

Such progressive states as Indiana, Michigan, New York, Texas and California typify those taking necessary legislative steps to allocate funds for either or both dangerous intersections and bridges and viaducts; or for lighting continuous sections through more populous districts.

There are now approximately 2000 miles of toll highways operating in this country. The protective illumination of the interchanges and toll plazas is logical and practical, both from a traffic safety and from a public patronage stand-point.

The Interstate Program

The Federal Interstate Highway program is certain to generate an increased realization of the need for protective visibility at night along many of these roads. It is predicted, therefore, that during the next five years more miles of inter-urban highways will be lighted than the sum total of such lighting to date. Direct requests from the public will be an important influencing factor.

And so, the challenging opportunity continues to exert even greater efforts to "Save Lives With Light", and to equip our roadway systems with such night seeing facilities as will assure a maximum return to the public from these investments.

● **TWIN-MOUNTED 400-watt mercury lamps provide an outstanding installation along downtown section of Wabash Avenue, in Chicago. Linear spacing is about 75 feet with an average intensity of about 5 ft.-candles on pavement and sidewalk.**

● **ONE OF the largest installations of 4-lamp fluorescent luminaires in the country is along Lake Street, Minneapolis. This illustration shows the excellent visibility resulting from these luminaires, using a 55-ft. staggered arrangement of standards.**

SEWAGE FLOW CONSIDERATIONS in INSTITUTIONAL TREATMENT PLANT DESIGN

THE DESIGN of institutional sewage treatment plants is generally predicated upon the average daily flow for the particular type of institution under consideration. Investigation is also made of plant behavior under minimum, maximum, and critical flow conditions in determining the arrangement of units and methods of plant operation.

Some of the uncertainties attending the design of municipal sewage treatment plants are not present. The quantity of sewage and the characteristics and quantity of the various industrial wastes that are to be treated in conjunction with the domestic sewage, not only at the time of the design but for a design period ten to fifteen years beyond the date of construction, do not need determination. The existing population of a state institution is known. The maximum population to be considered is a matter of state policy that can be definitely established for the period of design. Consequently, domestic sewage contributions may be more closely approximated. There are a number of factors, however, that require special attention. The relationship of the number of staff employees to patient population and the percentage of staff that are resident and non-resident members must be considered in estimating the quantity of sewage to be treated. In addition there are industrial wastes, which at New York State institutions may be derived from canning, slaughtering, and laundry operations.

Rigid daily schedules, a situation peculiar to institutions, have a marked effect upon the variation in the sewage flows. In addition, behavioristic patterns of inmates in penal institutions and patients in mental hospitals result in high flows and frequent fluctuations. Continuous flushing of fixtures and induced shutoff of flush valves are frequent and troublesome occurrences, resulting in large and pronounced fluctuations in sewage flows. The layout of most institutions is generally compact so that the sewage from the various building groups and other contributing sources quickly reaches the sewage treatment plant.

Infiltration into institutional sewer systems is less than in municipal systems because of a minimum of house connections and total length of sewers. Institutional buildings house large numbers of patients with sewer connections for fixture groups rather than individual households as in residence community areas. The length of sewer per hundred population is much less than in municipal systems.

In municipalities the portion of the water consumption which fails to reach the sewers through losses and non-contributory uses is balanced by the additions to the sewage flow by storm water and infiltration. As a result, the sewage flow will approximate the water consumption, although specific cities may have a sewage flow of 50 to 150 percent of the water consumption. The comparative records of a number of institutions in New York State, in contrast, show that the sewage reaching the treatment plants is equivalent to 78.4 percent of the water used. Losses occur from leakages, lawn sprinkling, and boiler make-up as most of the institutions have their own steam power plants. In some cases the use of "rain-maker" irrigation systems on institutional farms during the growing season consume considerable quantities of water that do not re-appear as sewage volumes. Losses from fire protection are not significant.

JOSEPH C. FEDERICK
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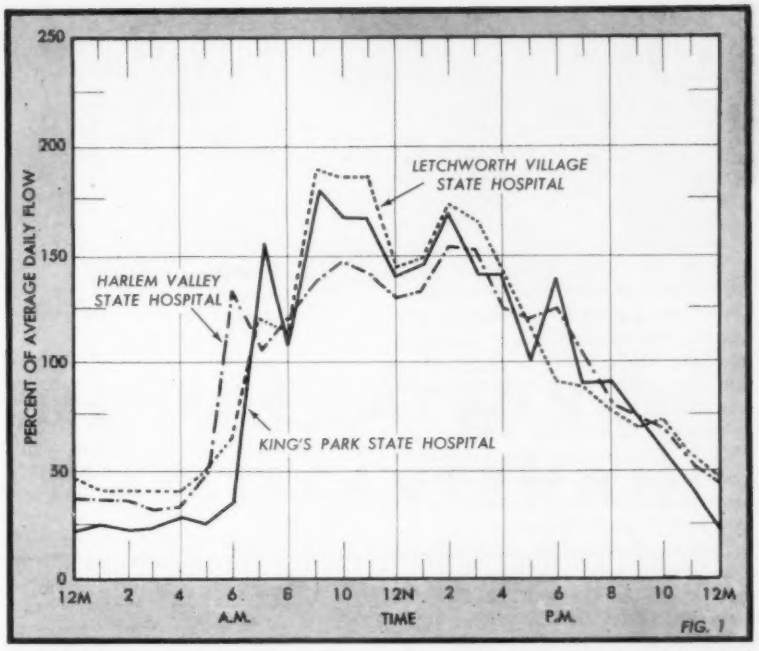
Sewage flow variations parallel and follow water consumption. The manner in which the sewage flow reflects the hospital operating routine is of interest; it is influenced by the fixed discipline with respect to retirement and arising of the institution population and the relatively constant number of night staff in attendance. The hourly variation is also affected by the topography and the orientation of structures as they relate to the sewerage system; the extent of canning, slaughtering, and dairying as a part of the institution's activities; and the quantity of infiltration from ground and storm water sources.

The hourly variations in sewage flows for King's Park State Hospital, Harlem Valley State Hospital, and Letchworth Village State Hospital, illustrated in Figure 1, are more pronounced than at municipal plants. Minimum flow occurs about midnight and the maximum is reached at 9 or 10 a.m. The minimum flow is 22 to 40 percent of the daily average. Morning peak flows occur about 9 o'clock when the institution activities are in full swing and are 150 to 200 percent of the average. The afternoon peak is somewhat less and occurs shortly after the noon-day meal, amounts to 150 to 175 percent of the average. In the institutions noted, the average daily flow curves are generally trimodal in form.

The average per capita flows at institutions are generally greater than at municipal plants. Table 1 gives the per capita average daily flow at a number of institutions in New York State. It is apparent that there is not only considerable variation in the average flows from institutions of various types but between those in the same category. Flows range from 38 to 304 gallons per capita per day, with an average contribution of 155 gpcd. The lowest flows occur at hospitals for the insane, with an average of 131 gpcd, and the prisons record the highest flows, 176 gpcd average.

Institutional sewage flows are lowest on Saturdays and Sundays, and the maximum average daily flow does not occur on any specific day as in municipal installations. The lower weekend flows are understandable as the laundry operations are not generally carried on during this period. The daily flows during the remainder of the week do not exhibit extremely large variations from the average, in some cases falling within narrow limits of 2 to 3 percent. The maximum variation from the average, under normal institutional conditions, occurs when heavy laundry loads, canning and similar tasks, and hydrotherapeutic operations are included in the daily schedule. Sunday, which is visitor's day, curtails the practices of some of the institutional population that add surplus water to the sewage plant unless they are under surveillance.

The variations in monthly flow are not significant; data from 18 institutions indicate the highest average monthly flow at 7 percent greater than the daily average for the year.



● **HOURLY variations in sewage flow at Kings Park State Hospital, Letchworth Village State Hospital and Harlem Valley State Hospital, all located in New York.**

Composition of Sewage

The 5-day BOD varies from 169 ppm at the Vocational Institute, West Coxsackie to 240 ppm at Kings Park State Hospital. The values for four institutions given do not diverge significantly from normal domestic municipal sewage. If adjusted for differences in flow between per capita municipal and institutional rates, the institutional sewage falls in the category of strong sewage. This is contrary to the usual concept of institutional sewage strength, which is generally held to be weak. The night-time sewage at Kings Park State Hospital is appreciably weaker than the daytime sewage with respect to BOD oxygen consumed, total and suspended solids, and grease content. The daytime BOD is 2 to 4 times the night-time value.

The large variation in flows, and the differences between municipal and institutional sewage, necessitate special considerations in designing institutional sewage treatment plants. Per capita values used for proportioning municipal treatment plant units are inapplicable. The plant must be designed on the basis of the type of institution to be served and utilizing available sewage analysis.

Table 1—Sewage Flows at New York State Institutions

TYPE OF INSTITUTION	AVG. GPCD 1949-1954	TYPE OF INSTITUTION	AVG. GPCD 1949-1954
State Prisons		*Defective Delinquents*	
Attica	104	Albion S. S.	220
Auburn	136		
Clinton	148	*Hospitals-Insane*	
Great Meadow	176	Central Islip	86
Green Haven	133	Gowanda	118
Sing Sing	252	Harlem Valley	110
Walkill	280	Hudson Valley	150
Woodbourne	181	Kings Park	94
		Marcy	216
Criminal Insane		Pilgrim	149
Matteawan S.H.	38	Rockland	100
		St. Lawrence	158
Reformatories		Utica	164
Elmira (male)	207	Willard	98
Westfield S. F. (female)	304		
		Mental Defectives	
Epileptics		Rome S.S.	105
Craig Colony (Sonyea)	89	Wassic S.S.	137
		Willowbrook	193

AVERAGE = 155 gpcd, RANGE = 38 to 304 gpcd

Basis of Design

In the design of sewage treatment plants for new institutions, a daily per capita flow of 150-300 gallons may be indicated. In cases where specific data were not available, the New York State Department of Public Works used 200 gpcd as a basis of design. Subsequent measurement and findings, after construction of facilities, have shown this basis to be satisfactory.

The population used in the determination of the composition of sewage to be treated should be the maximum contemplated future population for the period of design. The maximum population to be served by any location is a matter of policy with respect to the functional use of the facilities concerned.

Institutions are rated on the basis of certified capacity; that is, a specified floor area per individual housed.

There are, however, certain conditions which may prevail, that necessitate consideration and adjustment. The first factor requiring attention is the possibility of overcrowding beyond the certified capacity. This may occur because of emergencies, transfers, delays in construction of additional facilities, patient additions not included in the population forecast, and similar conditions.

Institutions also have large operating staffs. Administrative and professional personnel, attendants, and the variety of trades and assistants required to operate and maintain the physical plant constitute a substantial addition to the contributing population. Some staff members reside in quarters on the institution grounds; others are non-resident employees. Each of the institutions is a self-contained community.

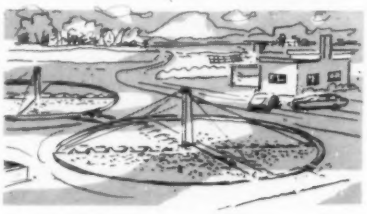
Some provision is desirable to compensate for variations and uncertainties in the sewage flow, to prevent inadequate detention periods in small units during peak flows, and otherwise to furnish a factor of safety. The above situations are provided for by the use of an equivalent capacity factor which may be considered somewhat analagous to the population equivalent in providing for industrial wastes in municipal plants.

The equivalent capacity factor, designated by the symbol "C", is composed of two parts, c_p the patient coefficient and c_s the staff coefficient, and is equal to their sum, or $C = c_p + c_s$. The coefficient c_p is the factor due to population overcrowding beyond rated or certified capacity. On the basis of records for the institutions under the jurisdiction of New York State, this factor may range from 0.2 to 0.4 depending upon the type of institution. The factor due to staff, c_s, may range from 0.18 to 0.4 in accordance with staff requirements, which in turn are influenced by departmental personnel policies. The equivalent capacity factor C is applied as a multiplier and is added to the certified capacity to obtain the equivalent population.

Equivalent capacity factors, the coefficients for patient overcrowding and the coefficients for staff allowances, as determined for New York State institutions are summarized in Table 2.

Table 2—Equivalent Capacity Factors New York State Institutions

TYPE OF INSTITUTION	c_p	c_s	C
Mental Hygiene			
Schools	0.40	0.25	0.65
Hospitals	0.20	0.34	0.54
Correction			
Prisons	—	0.18-0.34	0.18-0.30
Social Welfare			
Schools	0.20	0.30	0.50
Homes	—	0.40	0.40



The estimate of sewage flow to be treated at the sewage treatment plant would be made on the basis of the design population. The design population equals the sum of the certified capacity of the institution and the equivalent population determined as previously explained. The average daily flow is the product of the design population and the average daily per capita flow. Minimum and maximum daily flows and peak hourly flows can be computed by the use of the factors applicable to the average daily flow. Where laundry and other industrial wastes are not included in the daily per capita allowances they must be separately estimated and added to the domestic sewage determination. Similarly, infiltration allowances estimated by conventional procedures should be included in the total sewage flow which is to be used as a basis of design.

Courtesy Chicago Pump Company

● **SEWAGE treatment plant for a small institution. Location frequently is close to dwellings, which necessitates a neat appearance and nuisance-free operation.**

Illustrative Example

The application of the principles discussed to the determination of the quantity of sewage to be expected at an institutional installation is illustrated by the problem which follows:

An institution is planned which will have a certified capacity of 6,000 patients when fully developed. The coefficient c_p for possible increase in patient population in excess of the certified capacity is 0.20. A coefficient of 0.33 is required for c_s to compensate for the staff. The average daily per capita sewage contribution is 200 gallons. The minimum, maximum, and 16-hour daily average flows are 30 percent, 250 percent and 125 percent of the average daily flow, respectively. Determine the flows for which the sewage treatment plant should be designed.

Solution: Design population equals the certified capacity plus equivalent population.

$C = c_p + c_s = 0.2 + 0.33 = 0.53$

Equiv. pop. $= 6000 \times 0.53 = 3180$

Design pop. $= 6000 + 3180 = 9180$

Average daily flow
= design pop. x average gpcd
= 9180 x 200 = 1,836,000
= 1.836 mgd

Min. flow = 1.836 x 0.3
= 0.551 mgd

Max. flow = 1.836 x 2.5
= 4.59 mgd

16-hour average = 1.836 x 1.25
= 2.295 mg

● HERE IS a typical mud-jack operation, showing tapered wooden pegs in holes already filled and more pegs ready for use.

MUDJACKING OPERATIONS *in* HIGHWAY MAINTENANCE

H. H. COOPER,

District Maintenance Engineer,

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Kalamazoo, Michigan

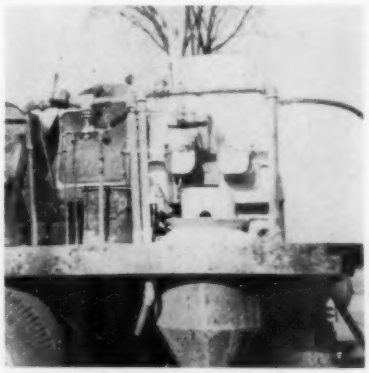
THE MICHIGAN State Highway Department Road Maintenance Manual, published in 1955, contains this definition: "Mudjacking consists of raising depressed sections of concrete pavements, curb and gutter, and sidewalk to their respective original levels, or to a satisfactory level, by means of pumping prepared mud or slurry under the affected areas."

This, certainly, is the chief purpose of mudjacking operations in highway maintenance; however, a second statement might read. "Where voids are known to exist under a concrete slab at bridge approaches, over utility trenches, and at other locations, such voids may be filled by use of mudjack operations without changing the elevation of the slab."

This filling of voids has been successfully completed, in recent years, under basement slabs in a number of industrial plants in Michigan. State Highway experience has included both raising of pavements, curb and gutter, and sidewalks and also the filling of voids.

The idea of mudjacking is not new. Michigan first began experimenting with home made equipment in the early 1930's. In the spring of 1931, a successful operation was completed using a piston type apparatus. Improvements in equipment, materials and procedures have developed over the years until today we have one compact unit which provides all the necessary power for drilling the holes in the slab, mixing the mud and forcing it under the slab. This equipment is mounted on a 5-ton flat-bed truck. Mudjack equipment is also available commerically.

● MUD-JACK equipment is mounted on 5-ton flat bed truck for easy use.



● BATCH mixer and controls from the front. Cone is the pressure chamber.

Our equipment, mounted on a 5-ton flat-bed truck, consists of an R-522 Chausse cement mixer powered by a 4-cylinder LeRoi gasoline engine; a Joy air compressor of 105 cubic feet capacity; a pressure chamber; other miscellaneous tools; and hoses. A 500-gallon water tank is towed with the equipment to provide a daily supply of water. One or two supply trucks for sand, lime and cement are also necessary.

Mudjack Mixes

Data on mudjack mixtures have been supplied over the years by the Department's Testing and Research laboratory and by field experiments directed by E. A. Dahlman, District Soils Engineer, during regular mudjacking operations. Mr. Dahlman has been especially helpful in his field check of mixes.

● REAR view of batch mixer with LeRoi engine and equipment at left.

Early mixes were actually "mud" made from screening topsoil and adding water. Such mixes were not entirely satifactory and before long marl and sand with water was found to give better results. This latter mix continued as standard procedure until the middle 1940's when used lime reclaimed from the processing of sugar beets replaced marl, and cement was added to the mix. It was found that a satisfactory mix contained 3 parts sugar beet lime, 1 part fine sand, 1 part cement and sufficient water to make the mix fluid. Asphalt, RC-1, was occasionally used in the mix at the rate of 2 gallons per batch of 1/4 cubic yard. The addition of asphalt caused the slurry to flow more freely and the mix to become harder and stronger. The step of adding asphalt slows up the work and is objectionable to the workmen due to the fact that frequently the slurry spills on their clothing and face, causing a slight burn. In general, asphalt is omitted from today's mix.

As previously stated, field experiments and improvement of equipment and procedures have caused slurry mixes to be revised until today we are obtaining very good results from a mix of 6 parts sand, 1 to 2 parts lime and 1/2 to 1 part cement. The exact proportions of the mix and amount of water added depend upon the experience and judgment of the mudjack operator. This final mix is based on the use of agricultural lime. If sugar beet lime or marl is used, their quantities are increased to more nearly equal the parts of sand used.

Procedure

A successful mudjack operation depends upon the experience and judgment of the mudjack foreman. He must understand the mechanics of slab pumping and how to analyze the joints and cracks in the slab to place the holes at locations to lift the slab without additional cracking of the slab or blow-out at the shoulder. Assisting him is a crew of 7 men: 2 men on the hose nozzle; mudjack operator; 2 men to supply sand, lime and cement to mixer; and 2 men as flagmen, 1 in front of operation and 1 in rear. The mudjack operation is, for the most part, stationary and, therefore, barricades and signs may be used to protect the men. As a result, one flagman can be used to plug the holes and clean slurry from the pavement.

Holes 2⅝ ins. in diameter are drilled through the slab at locations designated by the mudjack foreman. In general, the holes are approximately on 8 ft. centers in two rows for each pavement lane. The holes alternate in the two rows so as to form a triangle providing about 5 square yards of surface for each hole. If necessary, the holes are deepened with an earth auger to allow the slurry a better opportunity to spread under the pavement.

The slurry is forced by air pressure from the pressure chamber through a high pressure hose into a 2½-inch diameter rubber nozzle. The foreman observes the movement of the slab and the rise of slurry in open holes. He then signals the operator to release the pressure when sufficient slurry has been forced into the hole. A tapered wooden peg is tamped into the filled hole and permitted to remain there until the slurry has set. These holes are permanently patched or filled with bituminous cold patch material. This procedure is continued in the remaining holes until the pavement is raised to its original level or until the foreman believes the slab has been raised as much as possible without additional cracking or failure. Usually a string-line is as accurate as is necessary for checking elevations on mudjack work.

Costs of the Work

The cost of mudjacking will vary as the wage scales vary. In Michigan during the summer of 1955, it cost approximately $1.50 to raise one square yard of pavement slab an average of 1 inch. This cost is based upon the treatment of 12 locations having a total of 2355 square yards in which 469 holes were drilled. Such a cost figure may, perhaps, be used for estimating a mudjack budget for future work. It also indicates that, where the existing slab is sound, a smooth riding surface can be obtained with much less expense than removing the slab and placing a concrete patch.

An ideal mix must be fluid enough to flow under air pressure and fill the void or raise the pavement. It must develop sufficient strength to support the slab loads and become impervious to surface or capillary moisture; and it must not be affected by varying weather conditions.

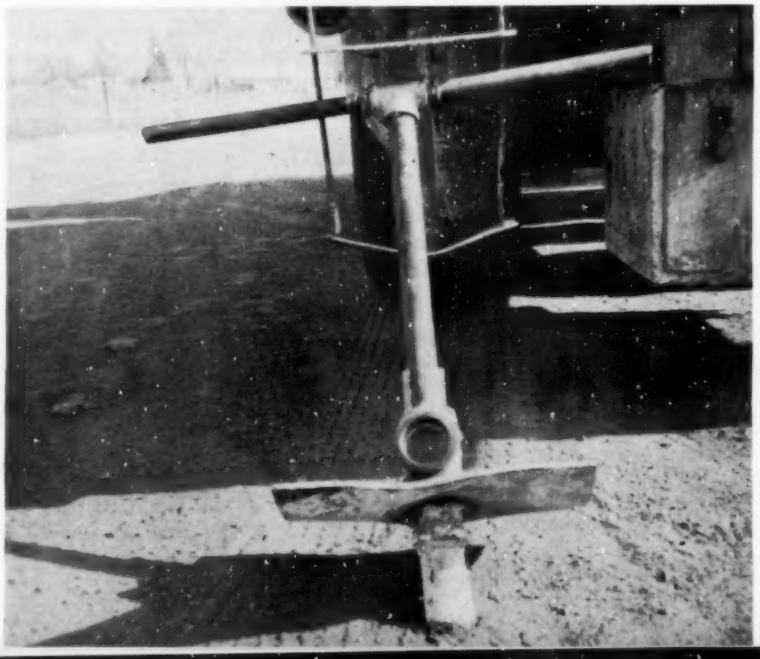
In attempting to raise a pavement slab more than 4 ins. or 6 ins. care must be taken to prevent a blow-out on the shoulder. If it appears that a blow-out will take place, the operation must be stopped until sheeting is driven along the edge of the pavement.

If the pavement seems to bind, a joint may be cut along a relatively straight transverse crack or an existing joint may be widened to free the slab. Air pressure may be lost on cinder, slag, and porous sand bases. Slabs on such bases are also more difficult to loosen. It sometimes becomes necessary to jar them loose with air blasts.

The mudjack operation is a sound and economical method of raising pavement slabs and filling voids. It is particularly adapted to correcting isolated dips on otherwise sound pavements.

The writer wishes to acknowledge the assistance and data furnished by George Rhines, in charge of the highway garage at Charlotte and E. A. Dahlman, District Soils Engr.

● **RUBBER nozzle and heavy rubber or belting splash guard are to protect workmen.**



REVERSE ROTARY WELL CONSTRUCTION

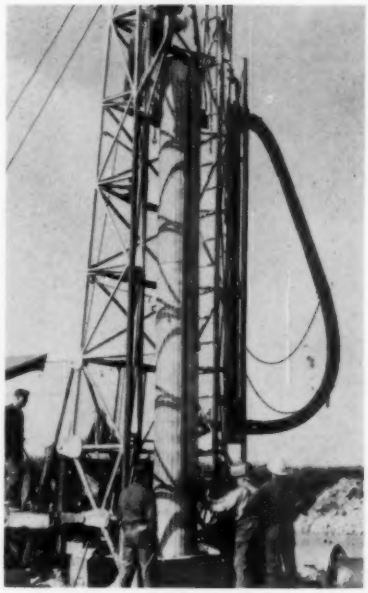
ROBERT T. SASMAN
Assistant Engineer
Illinois State Water Survey
Urbana, Illinois

THE GROWING population and per capita consumption of water at Champaign-Urbana are increasing the need for wells of greater and greater capacity. Tubular screened wells constructed 35 or 40 years ago were 8 to 18 inches in diameter and had capacities of about 100 gpm each. Recently-constructed wells are 3 to 4 ft. in diameter with up to one foot thick gravel-pack around the screen. These have yielded more than 10 times the amount of the early wells. One of the newest wells has a depth of 313 ft. and an available capacity of more than 3000 gpm.

A serious water shortage in the community in 1946 resulted in an extensive investigation program to locate additional water supply sources. Identification was made of Kansan-age glacial deposits in the pre-glacial Mahomet buried bedrock valley a few miles west of Champaign-Urbana. This deposit has since proved to be one of the better water-yielding formations in Illinois.

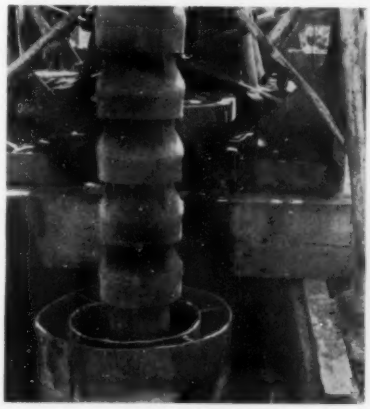
Following the 1946 investigation, four wells were drilled, three in 1947 and one in 1950. These wells have supplied most of the municipal demand since their completion. Each of the wells is of gravel-pack construction and has a capacity of more than 1,000 gpm. Also as a result of the investigation, a site was selected in 1946 for a fifth well. This well was recently completed and will be used to augment the present supply for the twin cities.

A test well drilled in 1946 at the site of well No. 52 pre-determined the depth and thickness of the primary water-bearing deposit in the Kansan drift. More than 100 ft. of sand and gravel were encountered, but the lower 75 ft. were considered to be the most satisfactory for the development of a high capacity well. Formation samples collected during the drilling of the test well enabled the size of the screen slots and the grade of the gravel pack to be determined prior to the drilling of the permanent well.



● **SCREEN alinement on a deep well requires care and good management.**

The well was drilled by the Thorpe Well Company of Des Moines, Iowa, using reverse hydraulic rotary drilling methods. This method, a rather common way of drilling high capacity wells in central Illinois, requires a large volume of water which flows from the supply pit into the well outside the drill stem. The water and drill cuttings are returned to the surface by suction through the drill stem. Keeping the well filled with water usually provides pressure sufficient to prevent the sides of the well from caving during the drilling process.



● **THE WELL has been finished and pump bowls are about to be set in place.**

In order to provide the large quantity of water necessary to drill a well of the intended size, an auxiliary well was constructed to supply water during the drilling operation. This auxiliary well, located about 150 ft. from the site of the permanent well, was drilled 15 ins. in diameter to a depth of 270 ft. by rotary drilling methods; 20 ft. of 8-in. diameter screen were placed in the well, followed by 8-in. diameter casing to the ground surface. The annulus outside the screen and the lower casing was filled with gravel. This well yielded about 200 gpm and, during the drilling of the permanent well, was used to keep the water supply pit filled with water. This water supply pit covered an area approximately 30 by 60 ft. and had a maximum depth of about 12 ft.

The lack of an airline in the auxiliary well prevented its being used for observation purposes during the production test of well No. 52. The casing was pulled and the well filled in upon completion of the permanent well.

The Permanent Well

The permanent well was started 56 ins. in diameter to provide for setting the surface drilling crib to a depth of 20 ft. It was continued 42 ins. in diameter for the next 200 ft. to a depth of 220 ft. At this depth, the 36-in. outer casing was set in place and, although one cave-in necessitated the removal of 144 ft. of casing and re-reaming the well, the entire 220 ft. were finally set in place. The annulus outside the 36-in. casing was then filled with cement grout up to a depth of 114 ft. Above the cement, the annulus was filled to within 10 ft. of the ground surface with sand back-fill. The top 10 ft. was filled with cement grout.

Below 220 ft., the well was underreamed to 48 ins. in diameter with an expandable bit and drilled this diameter to a total depth of 314.5

ft. The well was then ready to receive the screen.

As a result of the 1946 test drilling, the screen selected was 24-in. diameter Thorpe Direct Slot stainless steel, with ⅜-in. slots. Four sections, or 75 ft. of screen welded together, were used. An 18-in. steel cone, welded to the bottom section of the screen, made the effective depth of the well 313 ft. The screen was welded to the 24-in. diameter inner casing which extended to two feet above the ground surface.

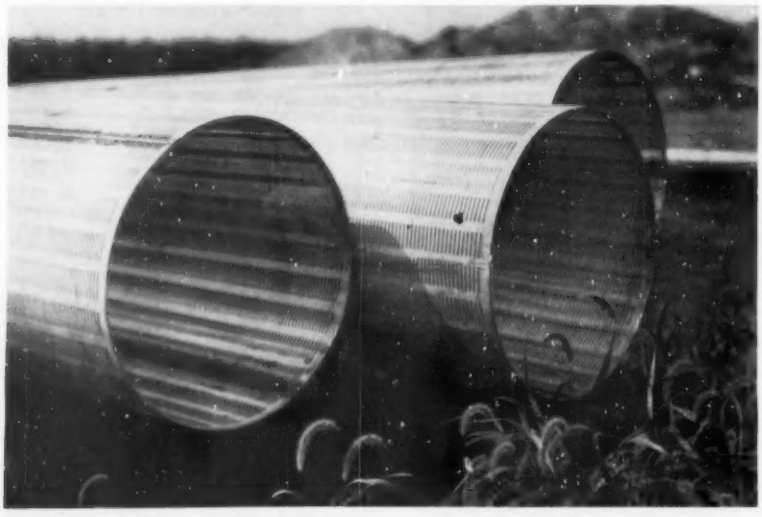
Before the gravel pack was put in place, a plumb bob was let down inside the 24-in. inner casing to determine its straightness. The plumb bob consisted of a 20-ft. section of 8-in. diameter pipe that had five half-circle metal strips welded to each end to increase the diameter to one inch less than the inside diameter of the casing. As the plumb bob was lowered into the well on a cable, measurements were taken at 20-ft. intervals to determine the amount the cable deviated from the center of the casing. A final check indicated that the straightness of the casing, for the depth of the well, was within six inches.

Placing the Gravel Pack

The gravel pack selected was composed of fine to medium gravel, with the majority of the pack in the range of medium. The pack was fed into the annulus between the two casings by a belt-fed conveyor. Mixed with the gravel pack as it was fed into the well were chlorine tablets and polyphosphate crystals to aid in disinfecting and developing the well. The annulus outside the screen and between the two casings was filled with gravel up to a depth of 50 ft. below the ground surface.

With the gravel pack in place, a high-capacity test pump, a Pomona turbine, was installed in the well. The first pumping period was of short duration for the purpose of cleaning formation sand from the well bore and settling the gravel pack in place. This pumping period was followed by a 48-hour production test. Present for observation purposes during the test were representatives of the drilling contractor, the water corporation and the Illinois State Water Survey. During the test a weir box was used, not only to measure the production capacity of the well, but also to determine the amount of sand pumped from the well. The weir box was a large reinforced wooden box with a rectangular opening in one end. Water from the well was discharged into the box and allowed to flow out through the rectangular opening. Measurements had been made by laboratory calibration of the exact number of gallons per minute for any height of water above the bottom of the opening. Although adequate drainage was not available to handle the full capacity of the well, it was pumped at a rate of 1,940 gpm with a water level recession in the well of 9.55 ft. Interference at the end of 48 hours pumping was measured to be one foot at a distance of 7,000 ft. and one-half foot at a distance of 11,000 ft.

● **MEASURING the flow from the well. Weir box is used during production tests. The well was producing 1080 gallons per minute with a drawdown of only 4.55 feet.**



● **SECTIONS of the screen used in the well described in this article. They are 24 inches in diameter, with ⅜-inch slots and are constructed of stainless steel.**

Based on this initial test, the water-yielding characteristics of the well compare very favorably with the better producing wells in Illinois. The performance of this well is a good indication that a well properly designed and constructed will yield a maximum amount of water with a minimum amount of drawdown for any given aquifer. Adequate spacing between wells reduces interference during pumping periods to a minimum.

The well was drilled for the Northern Illinois Water Corp., which supplies water to the University and to the cities of Urbana and Champaign. The total cost was $21,500.

Incinerator

WILL SOLVE MANY REFUSE PROBLEMS

AN INCINERATOR, now under construction in Evanston, Ill., includes a number of interesting design features. Stack discharges will be held to a minimum solids content; refuse handling costs will be reduced; and ash disposal problems may be eliminated. Scheduled for completion during the summer of 1957, the new 2-unit plant, which was designed by Greeley & Hansen, will have a capacity of 180 tons in 24 hours. The cost will be approximately $745,000.

In brief, here is how the incinerator will be operated: Refuse trucks, after being weighed on existing Fairbanks-Morse scales at the old incinerator a few hundred feet away, will dump into a storage pit. This has a below-floor capacity of 30,000 cu. ft. An overhead P&H crane, with a rated capacity of 3 tons, and equipped with a 1½-yd. bucket, will feed the two furnaces. After passing through the furnace, the residue falls through ash gates into trucks positioned below for removal to Doetsch Pit, as one of the city dump areas is called. Special provisions are made to limit the amount of particulate matter discharged from the stack.

With a population of about 75,000, Evanston collected 9,820 tons of mixed refuse during 1955, and 101,886 cu. yds. of non-combustible refuse. Collection is by city forces, serving all residences and all apartments containing no more than four dwelling units. In addition refuse amounting to more than 2,000 tons was brought in by local scavengers. Evanston has an incinerator, built 35 years ago, which has a rated capacity of 60 tons per 24 hours. This has been operating at full capacity, or at overload during some periods, but has been unable to handle all of the combustible refuse. As a result, it was necessary to use the Oakton St. dump for disposal of the surplus. This is basically an open dump. Refuse is burned when it is brought in; and when dirt happens to be brought to the fill, an earth cover is provided. However, covering of the refuse has not been a regular practice. This dump is also a depository for all non-combustible refuse collected by either the city or by scavengers; and also for the ash residue from the old incinerator plant. Originally an area of some 50 acres and 40 to 50 ft. deep, the available dumping space is now practically exhausted.

In the next 20 years Evanston's population is expected to reach 100,000 and the mixed refuse to amount to 13,000 tons a year, assuming no per capita increase in refuse production. The tonnage of mixed refuse loads brought in by private collectors is also expected to increase. The new incinerator and the Doetsch Pit, which has an area of 17 acres and a capacity of 350,000 cu. yds., are expected to handle the increased production for a considerable time in the future.

Besides lack of reserve capacity, the present incinerator suffers from other drawbacks that reduce its effectiveness. The dumping floor can accommodate only a limited amount of refuse at a time. Because of this situation, the city collection trucks must frequently queue up for half an hour or more in front of the plant waiting to dump their loads. As a result, collection routes have had to be shortened to allow for this delay.

Evanston's mixed refuse is collected by nine city trucks—four 1956 model Heil Collecto-Packs, and five 1955 model Leach Load-Packers—all of 16 cu. yd. capacity. The routes contain from 800 to 1500 stops. Supt. Edwin Smedberg believes that by eliminating the present delays prior to dumping of each load, the new incinerator will make it possible to reduce the number of collection routes from nine to eight, with a resultant saving of manpower and equipment.

Another problem with the existing plant is that the stack discharge contains a high percentage of suspended matter that forms a thick layer of dust in the surrounding area. In Supt. Smedberg's office, a few hundred feet away from the plant, this dust settles on walls, floor, and furniture to a depth of up to one-quarter of an inch at times. Ashes have to be removed manually. Chimney blowback is a frequent problem, due partially to over-accumulation of ashes and partially to the fact that the chimney develops insufficient draft for peak operating needs. Combustion is sometimes incomplete and, as a result, the ashes sometimes give off an odor that occasionally arouses the ire of Evanston residents. Fortunately the dump now in use is in a thinly-settled area. However, a number of fine residences are located adjacent to the Doetsch Pit; thus, better incineration is almost mandatory.

In the new plant extra-liberal capacities have been provided to keep the burning rate and the speed of gases low, and to produce maximum fly ash fallout in the combustion and subsidence chambers. The incineration operation begins at a concrete apron running along one wall of the new building. This wall is formed by three rolling doors. When the doors are raised, as many as five trucks can back up to the lip of the 20-ft. deep storage pit and dump their loads.

Plant Operation

The P&H overhead crane feeds each of the two furnaces through hopper openings. At the bottom of each hopper are two Beaumont-Birch charging gates. Refuse passes through these gates onto the rear of the grate. From this point it is moved toward the front of the furnace by Flynn & Emrich stoker bars, four sections of which are installed in each furnace. There are 11 bars per section, and each section is inclined downward toward the front of the furnace at a slope of 15 deg.

The stoker bars, hydraulically operated, eliminate the need for hoes, rakes, and other hand equipment. Their action keeps the refuse porous and properly distributed, prevents the formation of large, troublesome clinkers, and promotes

PHIL HIRSCH

uniform burning conditions. As a result, uniformly high operating temperatures can be maintained at all times. Also, drying and burning time, and the effects of thermal shock on refractory brick, are minimized.

Each furnace will burn approximately 90 tons of mixed refuse per 24 hours—53.5 lbs. per sq. ft. per hour. Inside area of each furnace is 140 sq. ft., and the inside volume (above grates) is 1225 cu. ft. Under average conditions (refuse with 40 percent moisture content, furnace temperature of 1800 deg. F), approximately 50,000 cu. ft. of flue gas will be produced per minute.

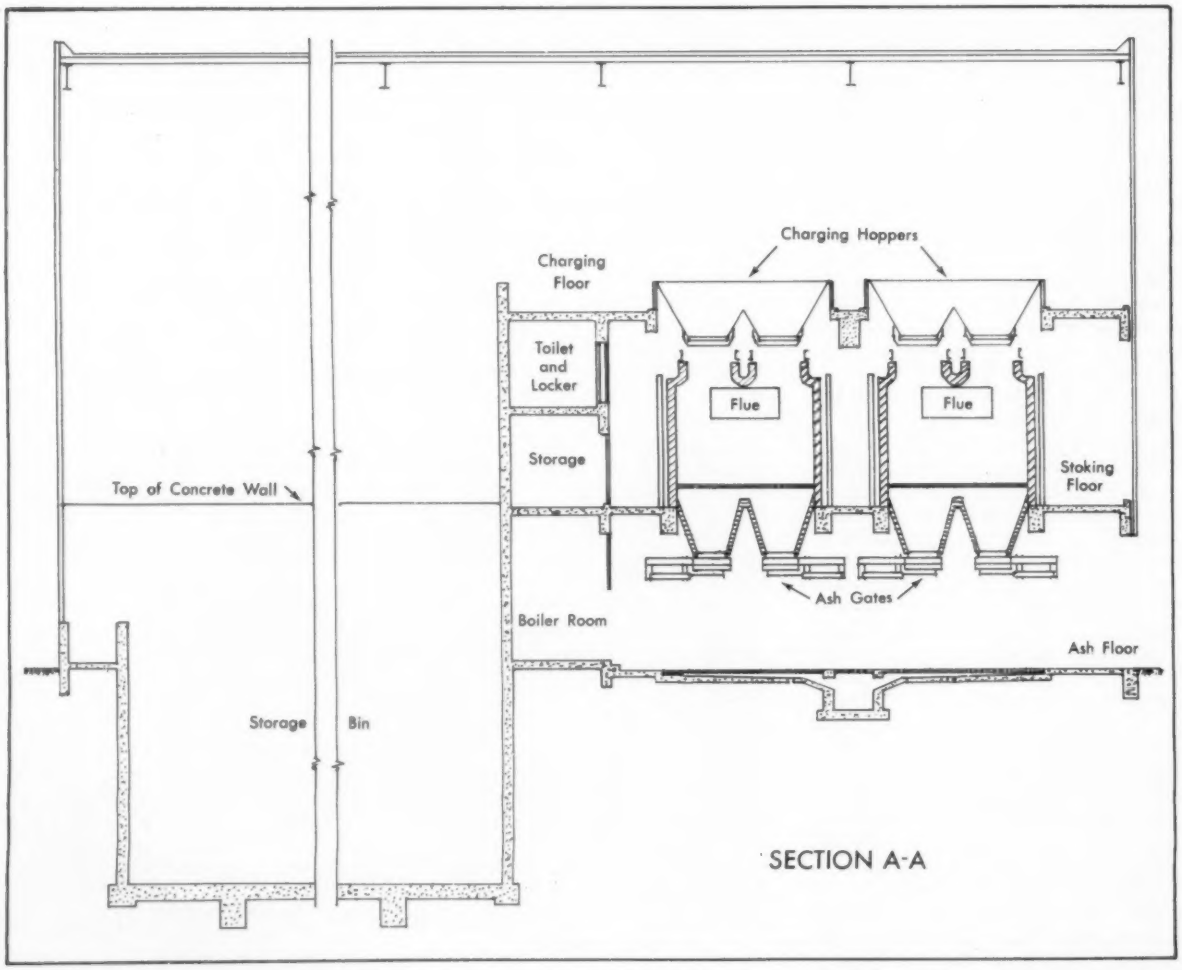
The opening between each furnace and combustion chamber has a cross-sectional area of 21 sq. ft. The combustion chamber contains 2550 cu. ft., and has a cross-sectional area of 59½ sq. ft. The subsidence chamber is 18 ft. long and has a volume of 8500 cu. ft. There are four baffle walls, each one ft. high, which are designed to keep fly ash from being swept up off the floor.

The subsidence chamber is built roughly in the shape of the letter "U." This design, by forcing the gas stream to make a number of sharp turns, tends to increase the amount of fallout. A trench 12 ins. deep covers about half of the subsidence chamber floor. It can be filled with water if needed as a means of lessening the amount of fly ash reaching the chimney.

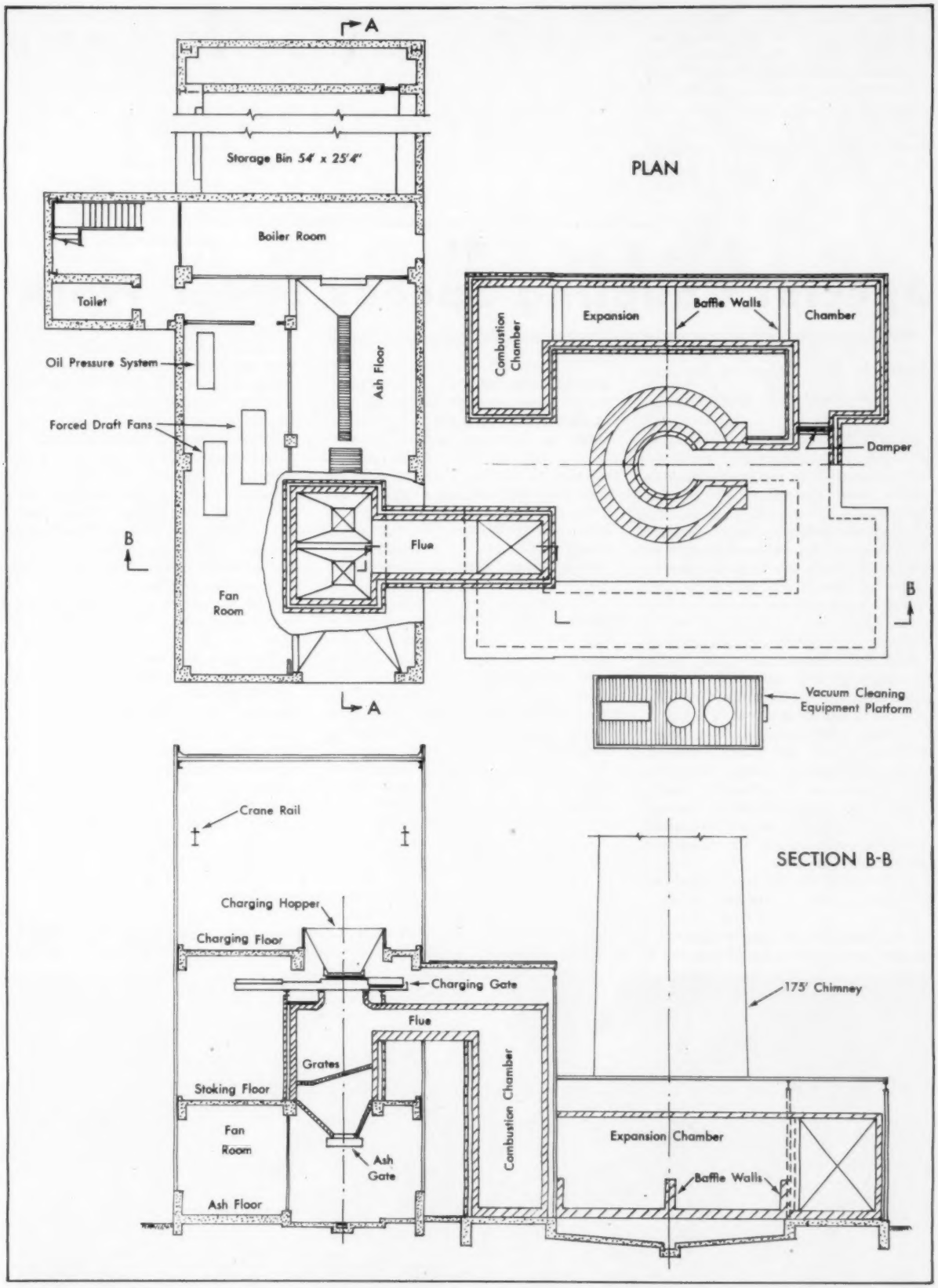
Fly ash will be removed from the subsidence chamber by means of a "vacuum cleaner" system used to date in relatively few incinerator plants. The system, manufactured by U. S. Hoffman Machinery Co., consists basically of a vacuum pump to which is connected a hose with a suction nozzle on the end of it. The nozzle, moved along the floor of the subsidence chamber manually, picks up deposited ash and sends it back through a two-stage centrifugal separator system. Here, the ashes that have been collected are removed. There is a discharge valve on the first separator, through which the ashes flow continuously into a hopper. Periodically, this hopper is opened manually, and the collected ashes fall into a truck parked beneath. In the second separator, where ashes passed by the first unit are trapped, the material is collected in filter bags, which are emptied into the primary discharge hopper as they become full. The vacuum pump that provides the suction needed for this cleaning operation is rated at 500 cfm. at 10.3 in. of mercury and 1300 cfm. at 8.4 in. The pump is powered by a 40-hp. motor.

Ashes from the furnaces will be quenched by means of a spray nozzle system installed in each ash hopper. There will be six nozzles mounted along the sides of each hopper. Each nozzle will have a nominal flow of 10 gpm. at a pressure of 25 psi.

No automatic temperature controls will be used. Temperature will



● **SECTION through the Evanston incinerator. Storage bin, foreshortened here, permits five trucks to dump at one time.**



● **PLAN AND SECTION** through combustion chamber. Note baffle walls which trap fly ash, later removed by vacuum cleaner.

be controlled mainly through a variable-speed drive on each of the forced draft fans. This speed control consists of a variable-pitch, V-belt drive, which can be operated automatically from the incinerator plant control board. The drive for the forced-draft fans is manufactured by U. S. Electrical Motors.

The chimney of Evanston's new incinerator plant is 175 ft. high, and has an inside diameter of 8 ft. Air is supplied to each furnace by a Clarage fan rated at 15,000 cfm. at 70 deg. and 5-in. static pressure. Each furnace has four overfire and two underfire air ducts, regulated by hand-operated dampers.

Initially, the plant will be operated on a two-shift basis five days a week. Later, as needed, the plant will be kept running 24 hours a day during the week, but will remain closed on weekends. No supplementary fuels will be used (they aren't necessary) for starting up after shutdown periods.

Special Coupling Speeds Sewer Work

PHILIP E. KLINE,
Shafer & Kline, Consulting Engineers
Overland Park, Kansas

A RECENT SEWER installation job south of Kansas City, Kansas, presented an unusually serious water problem. The job was a lateral sewer installation in the Tomahawk Ridge housing addition. The cause of the water problem was one of the main assets to the developers of the site—a five acre lake which bordered on a part of the area. The lake level was 10 to 15 feet higher than the ground level on which the addition was being built. A rainy period, plus the seepage from the lake, completely saturated the area to be sewered.

Dickey vitrified clay sewer pipe was used for the lateral sewers, with conventional joints. However, the extreme mud and water conditions of the trenches limited footage of 8-inch pipe laid to only 923 in 12 working days, an average of 77 feet of pipe per day.

After study by the contractor, the developer and our inspection staff, it was decided to try the Dickey PVC Coupling on this job. This coupling consists of rings, accurately molded and fused on the spigot and in the bell of the pipe. A joint is made by applying lubricant-sealer to the surfaces of the coupling and pushing the spigot into the socket. This can be done in a trench by using a shovel, bar or other simple lever. According to the manufacturer, joints could be made with this coupling, even in water-filled trenches.

The plan called for starting at Manhole No. 23 with this coupling; but 60 feet from the manhole we ran into a deadend. Sufficient pumps were not available to remove the rising water. Working room was at a minimum, and cave-ins were frequent, even with sheeting. The new coupling was brought into use, with the result that 51 feet of pipe were laid in the next four hours. Parts of the pipe were under water at all times—at some points almost totally. The lubricant sealer, insoluble in water, was brushed onto the bell end even on surfaces under water. All spigot ends were generously coated above the water and the joint was made easily. Trench conditions north of manhole 23 were almost identical to those on the south; but in less than a full day on this stretch, 209 feet of pipe were laid.

The next line of pipe was laid parallel to the lake and there was always at least a foot of water in the trench. We would have had much more except that the water was allowed to run into the manhole and down the previously-laid lines. This section of the trench was also heavily shored for the pipe-laying operation. In the five hours worked that day, 147 feet of pipe were laid.

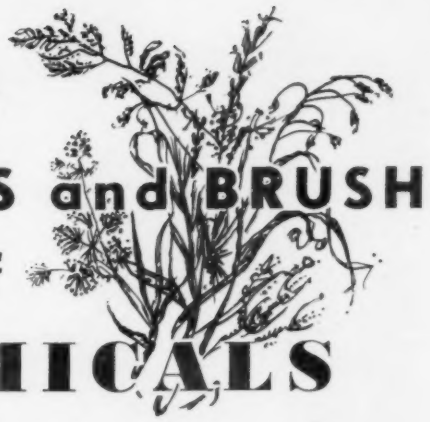
With the line between Manholes 23 and 24 backfilled, it was lamped and examined for infiltration. The complete circle observed at the far end of the pipe indicated a straight line with a smooth invert. Although definitely under a head of several feet of water, no trace of infiltration was found.

Based on the cost of laying and jointing the pipe, a saving of $1.18 per foot was estimated to result from the use of the new type of coupling.

● **SATURATED soil nearly defeated the contractor engaged in this lateral sewer installation for a lakeside development.**

● **APPLYING lubricant-sealer to spigot of pipe section. Dickey PVC couplings made a tight seal even under water.**

CONTROLLING ROADSIDE WEEDS and BRUSH by use of CHEMICALS



MALOY QUINN,
Clay County Engineer,
Clay Center, Kansas

USE OF CHEMICALS to control weeds and brush does not eliminate the use of the mowing machine, but it does make a mowing machine much easier and cheaper to use, and the road-side and ditches are kept in much better condition. In fact, we have found that, by the use of chemicals on perennial weeds, including some of the noxious weeds, such as bindweed and Johnson grass, or on any of the broad leaf vegetation, we grow a much better mat of the natural blue stem grass of this area. This gives our roads a pleasing appearance, is easy to mow and eliminates a great deal of the erosion caused by wash.

With dimensions 24 by 30 miles, Clay County is an average size county in the state of Kansas. The county highway department has control of 225 miles of road along which, for a great number of years, we have controlled the growth of weeds, brush, etc., by the use of chemicals.

Back in 1937, I believe, Professor J. W. Stanley, of Kansas State Agriculture College, discovered that sodium chlorate was a first class herbicide; and this chemical was first used in our county shortly after that, probably about 1938. Sodium chlorate was used for four or five years; however, it killed all vegetation and in addition was very flammable. It was not nearly as satisfactory as the 2,4-Dichlorophenoxyacetic acid, better known as 2,4-D, which we have used for the last eight to ten years. In between the sodium chlorate and the 2,4-D there were several other weed-killers such as salt. Salt has always been a good weed killer; however, it does sterilize the ground and kills all vegetation around it and is, therefore, not too satisfactory along the roadside. We have used 2,4-D and 2,4,5-T ever since it has been available. Now the 2,4,5-T is used exclusively for the control of brush, but the 2,4-D is a little cheaper and is used to control the broad leaf plants. The weeds along the roadside are mostly sunflower, cocklebur, rag weed, golden rod, iron weed, pig weed and, of course, some bindweed and a small amount of Johnson grass. Control of the so-called noxious weeds is required by State law.

Our present equipment consists of a John Bean all-purpose sprayer with a road-side spraying nozzle mounted on the front of a 3/4-ton pickup truck. For ordinary control of weeds we spray once each spring, beginning about May or, depending on weather conditions, when weeds begin to grow. We continue until we have sprayed the entire mileage of our county highways. The average application is three pounds actual 2,4-D acid per mile. This, normally, is mixed with water and sprayed. Our crew consists of two men, one to drive, and one to watch the spray.

We have found from experience that, when we go by an Alfalfa field or a flower-filled yard, we must not spray because of probable damage to those particular crops and flowers by 2,4-D. Of course, it sounds funny, but through the years we have been accused of killing ducks and chickens, making cattle sick, and killing a tomato crop and rose bushes almost a quarter of a mile from the road. However, we are convinced by actual tests made by the State college that no damage can come to an animal from the amount of spray used along the highway. We are sure, beyond reasonable doubt, that in no case have we ever killed a rose bush or a potato crop or tomatoes. As far as that is concerned in the three cases I recall, we found after investigation, that the owner had sprayed to kill bugs with the same sprayer he had used to kill bindweed. But whenever the property owner asks us not to spray by his place we readily acquiesce to his request.

The cost of weed control by chemicals, according to our figures, runs about $4 to $6 per mile. We

● **BRUSH growth at side of County road, killed by chemicals, is easily removed.**

● SPRAY OUTFIT used by Clay County to control bindweed and other growths.

no longer have the tall sunflower growing along the road or the big weeds to mow which can cause considerable damage to the mowing equipment. A great number of permanently surfaced roads now have a good mat of blue stem growing on the shoulders, in the ditch and on the backslope. Erosion has been largely controlled through this simple operation. We find it necessary, with the use of chemicals, to mow two or three times per year. The total cost of the control of weeds, including the mowing is approximately $24 per mile. This may vary according to the amount of moisture received.

Brush control is somewhat of a different problem. We have sumac, wild plum, and hedge root (the Osage orange) as the principal brushes that give us trouble. By using a spray composed of half 2,4-D and half 2,4,5-T mixed with water we find that such brush can be controlled. Again care has to be exercised that we do not kill a hedge fence or ornamental shrubs or hedges. In all cases we have been very careful to see that good judgement was used in applying brush control spray. We have gone along hedge rows that were too close to the ditch and sprayed the underneath part of it. In no case do I know where it has killed the whole growth, but it has made it possible to trim out and clean up the ditches that were being covered by such hedges growing out over them. We have many places where roads have been widened and the hedges grubbed; then sprouts come from the roots and regrow in the ditch. We find that chemical brush control, in such cases, is necessary and efficient. Another use that we have found for this mixture is in the control of growths in channel changes and large road side ditches. In such places, small trees, as willow and the cottonwood, which are very common in this area, grow up and fill the channel. By cutting these down in the winter and painting the stump with 2,4-D, even though it's only an inch or two in diameter, we stop all regrowth of this particular tree, leaving the channel clean for two or three years.

Road Maintainer's Friend

The use of chemicals does not kill the grass or other desirable vegetation. It does assist in the control of noxious weeds which are continuously spread along the highway both by beast and vehicle. It controls the perennial weed and the annual weed, including the Kansas sunflower, which grows prolifically along the highway. We feel that 2,4-D is the road builder's friend, or maybe I should say the road maintainer's friend.

As in other Kansas Counties, Clay County has a Weed Supervisor, which is a separate office from the County Highway Department; but both offices work closely together.

GETTING 10,000 PARKING SPACES *for* CORAL GABLES

C. E. WRIGHT

FEW, IF ANY, municipalities in the country have solved the automobile parking problem, but Coral Gables, Fla., claims to have come as close as any to a solution. Its program has been so successful that it has attracted the attention of many other cities.

Like many Florida cities, Coral Gables has had a dual problem in providing adequate parking spaces —the rapid increase in resident population and the large influx of visitors, particularly during the winter season. A special Dade County census, taken in 1955 by the U. S. Bureau of Census, showed a resident population of 29,210, which was a gain of 47.75 percent in five years. On top of this, Coral Gables has an estimated 40,000 visitors during the winter months. These stay from a week or two to a full season; and besides there are the daily visitors who come from Miami and elsewhere, some of them to shop in the famed Miracle Mile business area, which has 180 shops of all kinds, many of them of the type to make a particular appeal to tourists.

In November, 1954, Coral Gables created an Off Street Parking Board, which immediately set to work to try to solve the parking problem, particularly in the business area. Municipal authorities recognized the fact that substantial ad

valorem revenue is directly derived from the central business district and other municipal revenue indirectly results from downtown payrolls and business activity. The Coral Gables Chamber of Commerce states this obvious fact:

"Landlords in the central business district are able to pay taxes only as they are able to realize income from their property; the income from their property is dependent upon the volume of business done by the occupants of the places of business; and the volume of business is dependent upon whether or not the central business district is attractive to customers in automobiles."

In Coral Gables, as elsewhere, individual merchants had not been successful in providing sufficient parking space. Angle parking was and is permitted on Miracle Mile, which is an avenue more than 100 ft. wide, but this was not enough, so the city assumed the responsibility for the provision of on-street and off-street parking facilities.

Prior to the appointment of the parking board, the city had obtained a parking and traffic study from Maurice H. Connell & Associates, engineers of Miami. This study constituted the basis for the work of the Off Street Parking Board. To finance work recommended by the engineers and the parking board, the city on April, 1955, authorized issuance of $1,000,000 of revenue certificates, redeemable from proceeds of parking meters and backed also by the franchise tax money, received by the city from the Florida Power & Light Co.

Proceeds from the sale of the certificates, which bear an interest rate of 3.2278 percent, were placed in a trust fund and spent as the availability of land for parking areas developed. The board, in acquiring vacant land, took into account the shopping habits and preferences of women customers. The greatest need was in the vicinity of Miracle Mile. One lot at the rear of stores has a capacity for 350 cars, another for 200 cars. Other lots have been developed elsewhere. The Connell report recommended that the city eventually acquire 2,000 off-street parking spaces. Another $1,000,000 issue of revenue certificates has been proposed. The Coral Gables plan for off-street parking, plus metered parking on streets and private parking facilities, now provides an estimated 10,000 parking spaces in the city, largely concentrated in the business area. The Off Street Parking Board has a continuing program. It anticipates that land in the central city may eventually become too valuable for parking spaces. When that time arrives, the city is prepared to build multi-storied parking garages on city-owned street-level parking locations.

● **PARKING facilities are featured in posters used by Coral Gables merchants.**

Although the Off Street Parking Board did not begin work until 1954, the city actually started on its program in 1950 under a plan proposed by George K. Zain, pioneer civic leader and Miracle Mile developer. The Zain plan provided for 25-year leases by the city from private property owners, with the city taking an option to buy at any time during the lease period. Private owners were to receive 35 percent of the annual gross meter revenue.

For continuance of the Coral Gables program, Willis G. Devere, attorney and treasurer of the Miracle Mile Association, has proposed another plan. It would provide for assessment of business property owners whose properties would be directly benefited by parking areas. He has proposed, for example, that the owner of business property pay a special assessment of $10 a foot front over a 10-year period. Thus the owner of a 50-ft. improved lot would pay $500, or $50 a year, to be reduced if meter revenue warranted. The Devere plan would provide an additional 250 to 300 parking spaces.

Experiences with SUBDIVISION REGULATION

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THE NEW YORK State law says that a subdivision "shall mean any tract of land which is hereafter divided into five or more parcels along an existing or proposed street, highway, easement or right-of-way for sale or for rent as residential plots or residential building plots, regardless of whether the lots or plots are to be sold or offered for sale, or leased for any period of time, or described by metes and bounds or by reference to a map or survey of the property or by any other method of description." Plans must be filed and approved before any lots are sold or buildings erected; the county clerk cannot accept plans for filing which do not have health department approval. Methods for obtaining and furnishing adequate and satisfactory water supply and sewerage facilities to the subdivision must be presented. The law does not apply to any subdivision in any city or county, which has a health department which has adopted or adopts regulations for the control of subdivisions. These regulations may require the installation of water supply and sewerage facilities in accordance with the approved plans.

The local option for review and approval of plans has been adopted by nine of the seventeen county health departments in New York State. Fifteen state health department district offices are now authorized to approve subdivision plans.

Public vs. Private Systems

While there is no doubt that provision of public water and sewerage facilities is in the best interest of the people, there are many rural areas in the country where septic tank systems and private wells are the only answer for the present and immediate future. Under such circumstances it becomes important that wells and septic tank leaching systems be properly designed, located, constructed and maintained to preserve a healthful environment as long as possible. Health department subdivision regulations and inspections can help assure this objective, provided soil percolation tests are properly made and interpreted.

Since the obtaining of public sanitary facilities is more difficult, some health officials perhaps have been led to approve individual sanitary facilities for want of a better answer. The lack of support from elected officials, the legal profession, and others can place a health department in a difficult position. This fact points to the need for planned and directed educational efforts to obtain the understanding and support of all the agencies and individuals involved.

Much has been done in recent years to show that community sanitary facilities can be planned and constructed to serve new land subdivisions. 45678. Public facilities can be promoted through various means. Some of the procedures that have been found most effective are discussed further below.

There is no question of the right of a state to adopt a subdivision control law as a proper exercise of its powers to protect the general health and welfare of the people. A county health department which enacts a local subdivision ordinance in its sanitary code pursuant to the state public health law has complete authority to enforce this local regulation even though adopted subsequent to the time the original public health law was enacted. This has been upheld in New York State and elsewhere [*59 N. Y. State Reports 221*].

Laws adopted for the control and promotion of orderly development of subdivisions in undeveloped areas show the legislative judgment that such building ought to be accompanied by the provision of essential facilities to meet the basic needs of new residents. To require the developer to provide the facilities or in the alternative to post a performance bond in favor of the Town is not unreasonable. This covers streets, paving, curbing, grading, sewers, sewage treatment plants, etc., as the town or other authorities may require [*Borous v. Smith 304 N.Y. 164*].

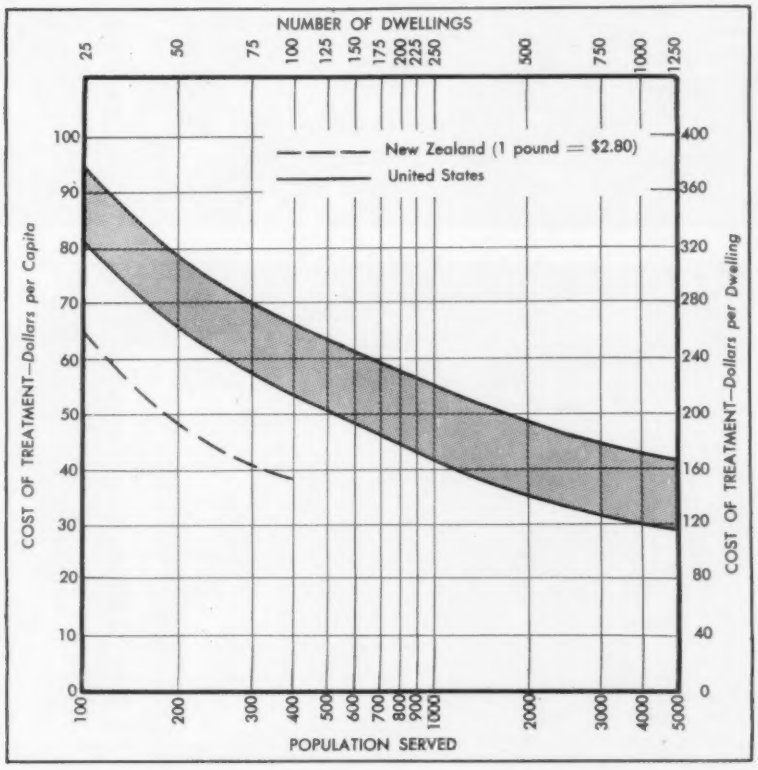
Violations of the sanitary code are misdemeanors and hence crimes. Subdividers need not be notified. [*J. Fisher, Erie Co. N.Y. vs Kuppel, 282 AD 825*]. Although this is so, leaders in public health believe strongly in education and persuasion as indispensable aids in carrying out their responsibilities. Immediate notification of the subdivider can prevent many of the problems from getting out of hand.

Violation of the subdivision law can be halted by injunction proceedings. Such a procedure was followed by the Erie County Health Department in New York State when a subdivider refused to submit a plan as required by the County Sanitary Code. A temporary injunction followed by a permanent injunction was granted by the County Supreme Court. An appeal to the State Appellate Division, Fourth Department, resulted in a judgment of unanimous affirmance. A further motion in the State Court of Appeals for leave to appeal from the judgment of affirmance in the Appellate Division was denied [*282 AD 825*].

This article is based on a paper presented before the Conference of Municipal Public Health Engineers, 84th Annual Meeting of the American Public Health Association, Atlantic City, N.J.

Agreements can be made for furnishing public facilities under the existing laws. The formation of service districts such as water districts and sewer districts on a subdivision, community, township, regional, county or drainage area basis are effective means of providing water and sewer service. In New York State, companies are permitted to operate a water utility, but not a sewage works. Contractual agreement between a city or village and an adjoining town to supply water or accept sewage is a common way of providing these essential services. A city, village, town or county may also contract indebtedness to enlarge its sewage works in order to handle the sewage of another improvement district. A common practice in subdivisions is the construction of sewers and, where needed, treatment plants, by the developer. This would be done in accordance with health department approved plans and after a service district is organized pursuant to law. It would be agreed beforehand that the water and sewer facilities would be turned over to the municipality at no cost, and that future maintenance and operation would be borne by the service district or municipality. In some areas a village, city or town may agree to reimburse the developer a percentage of the cost of sewers and water lines, after they are installed and homes are connected.

Another possible alternative is the installation of water or sewer lines by the town, provided the developer posts a bond for the total contract cost in favor of the municipality. A service district is required to be formed. The developer is relieved of his commitment when sufficient homes are constructed to support a reasonable bond issue to pay for the facilities.



● **COST of sewage plants providing secondary treatment, as of 1952. These figures do not include cost of land or engineering, legal and related incidental charges.**

Health Department Authority

The determination that an area is a subdivision subject to the subdivision regulations is made in the first instance by the health department. It has substantial discretionary powers in carrying out its legal responsibilities. In a Supreme Court action in New York State, the Court upheld the right of the State Commission of Health to refuse to approve a land subdivision with septic tank systems and to require the installation of sewers. The State Health Department, in carrying out its duty to protect the public health, was considered competent to determine whether or not the submitted plans showed adequate and satisfactory sewerage facilities as required by the law. [*Gulino Construction Corporation vs. Dr. Herman E. Hilleboe—1956, N.Y. State*].

Another pertinent example of the value of local determination is the experience reported in Pennsylvania[9]. Marple Township adopted a policy in 1952 and an ordinance in March 1954. In a Delaware County Court decision, the right of a town to require a subdivider to provide public sewerage, or in the absence of a main collecting line, dry sewers in the streets, installed in accordance with a town master plan was upheld. This was considered a proper exercise of town authority for the protection of the health and welfare of the people. The Pennsylvania Superior Court on appeal decided the developer had no right to appeal. It is important that the ordinance permits a municipality to plan a complete sewerage program intelligently. It also commits the municipality to the program and its orderly prosecution within a reasonable time (say 5 years) and within its financial limitations. The home owner is supplied with a sewer when the house is built which is the least expensive way as streets, front lawns and utilities are not torn up and replaced at a later date.

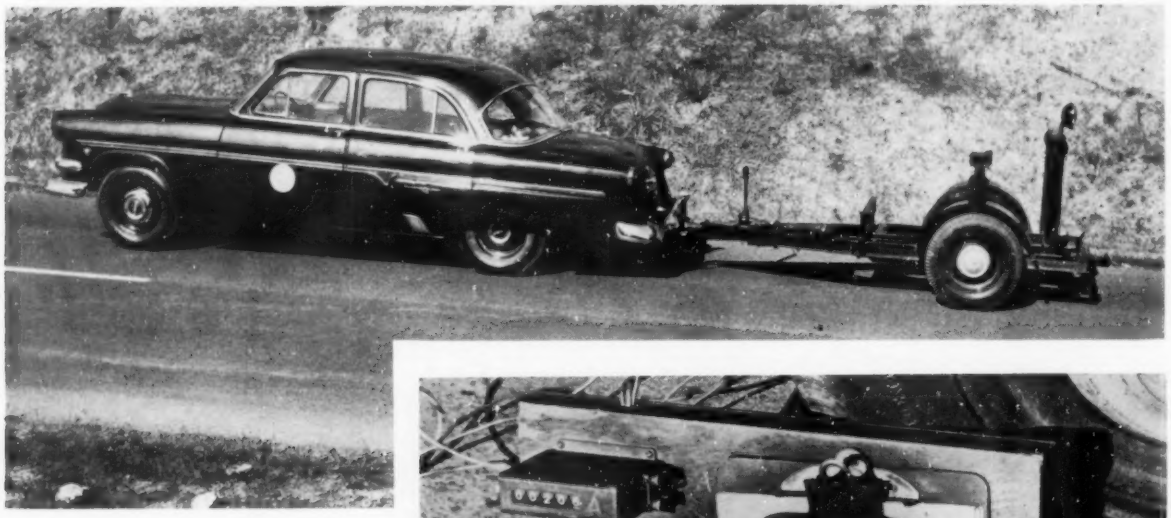
The Marple ordinance is similar to a regulation suggested by the American Society of Civil Engineers in their land subdivision manual of 1939 [2].

Fringe and rural area sanitation is an aspect of healthful living which is directly related to the housing problem in urban and rural areas. Health departments should act as catalysts for they can only do part of the job that needs to be done. The combined talents and resources of many private as well as official agencies and individuals are needed to prevent insanitary conditions and promote good helath. Those who can contribute to this goal are the planning and zoning boards, realtors, developers and builders, consulting engineers and local officials, private lending institutions, the Federal Housing Administration and Veterans Administration, legislators and attorneys, the press and the people.

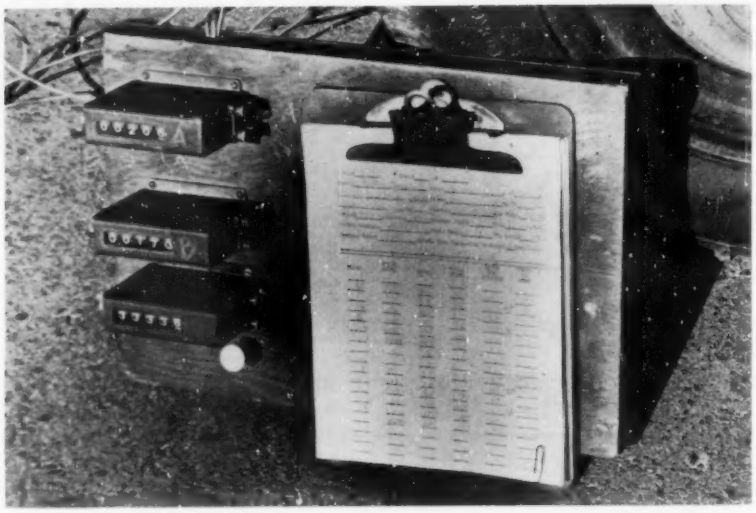
If any of these groups or their representatives do not understand the water and sewerage problems associated with housing in subdivisions or fringe areas, they cannot be expected to cooperate in the

(*Continued on page* 191)

North Carolina
MEASURES ROUGHNESS OF ROADS



C. E. PROUDLEY,
Chief Materials Engineer,
North Carolina State Highway
and Public Works Commission



● **ROAD ROUGHNESS indicator is suspended on a two-wheel trailer en route to a project. In operation, the indicator, which has a single wheel, is towed behind the car at 20 mph. Inset shows the recording panel and data board which is used by the technician in the towing car. Top counters record vertical inches of movement and bottom counter gives number of revolutions of the roughometer wheel.**

THE TRAVELING public judges a road by the degree of comfort experienced while driving on it. Several factors enter into the overall evaluation such as width, curves, capacity for the traffic it handles, etc.; but when the reaction is boiled down to one word it is either "good" or it is "rough". Recognizing that roughness is the basic consideration the North Carolina State Highway Division of Materials has had a Road Roughness Indicator, generally referred to as the "Roughometer", built in its shops according to the design by the Bureau of Public Roads. Measurements were first made in North Carolina in 1949 on a number of newly built pavements, both bituminous and portland cement concrete.

Those who have been using this type of roughometer have agreed on a rating of degrees of roughness or smoothness from "excellent" to "poor" stated in inches per mile, which is the accumulative number of inches the wheel of the roughometer travels vertically with reference to the frame of the machine as it traverses one mile of pavement. The roughometer is towed at a uniform rate of 20 mph and as the single smooth, pneumatic, rubber-tired wheel bounces over rough spots the movement of the axle of the wheel is recorded through a special ball clutch attached to the spring - and - shock - absorber suspended wheel. Through electrical integrating instruments the motion is transmitted to counters in the towing vehicle where a Technician observes the values on them and later computes the inches per mile. A run is made in both directions in units of one-tenth mile each. This procedure indicates whether the road is uniformly rough or varies from one point to another.

Although it is a matter of opinion and will vary with the type and design of vehicle in which you are riding, the following general values for rating the roughness or smoothness of a road have been developed and are shown in the accompanying table.

Measurements have been made on 26 bituminous concrete and sand-asphalt pavements built in 1946. After ten years of service these average 60.4 inches per mile. The smoothest was 48.4 and the

roughest was 80.7 inches per mile.

Five projects of plain portland cement concrete which are 5 to 7 years old were measured recently and averaged 96.4 inches per mile, the smoothest being 87.0 inches and the roughest 109.6. Contraction joints which are spaced at 30-ft. intervals add considerably to the measured roughness.

One of the most important uses of the roughometer is in the evaluation of the design of the bituminous paving mixtures. It is the present practice to measure the roughness of a new bituminous plant mix pavement as soon as it is opened to traffic and at approximately one-year intervals thereafter. Those pavements that show a negligible change in the inches per mile from year to year, assuming that the traffic has been heavy enough to warrant a high type of pavement, are considered to be well designed and constructed.

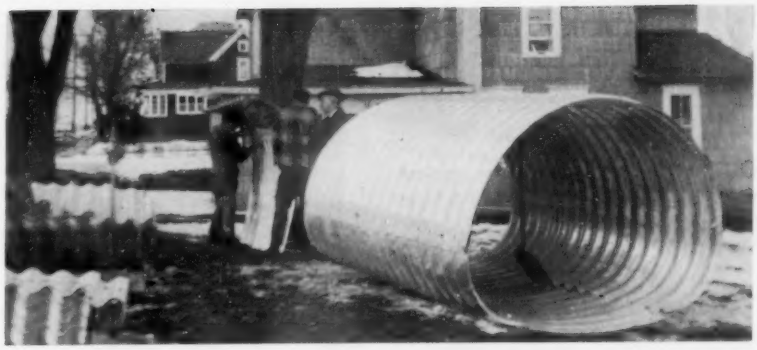
Roughness Index *vertical inches per mile*	Riding Qualities
50 - 60	Excellent
60 - 75	Good
75 - 85	Fair
Above 85	Poor

There have been improvements in the design of the Road Roughness Indicator, some of which have been added to the North Carolina apparatus. The first was the construction of a two-wheel trailer for transporting the roughometer between jobs thereby saving the wear and tear caused by many miles of inoperative travel. Another improvement devised by the Institute of Transportation and Traffic Engineering at the University of California is the use of an oscillograph recorder which gives a continuous record. This is especially valuable as a means of showing where corrective maintenance or repairs are needed on the basis of numerical data.

• • •

Total Valuation of All Roads and Bridges

The 1956 Annual Report for Big Stone County, Minnesota, states that the total valuation of all roads and bridges in the county amounts to $2,154,850. There are 136.5 miles of state aid roads, 0.9 mile of state aid parkway and 264 miles of county aid roads. The number of bridges in the county was not given.



CULVERT EXTENSION WITH CORRUGATED PIPE

C. LELAND WOOD,
City Manager,
Watertown, N. Y.

A SMALL BROOK which flows in a square stone culvert under Mill Street in Watertown, New York, has recently been declared a health menace and fire hazard. Some factory wastes and water discharged from street storm sewers during rains increase the ordinary low stream flow. When the water recedes oily wastes which enter the brook cause an unsightly condition along the banks of the stream and the adjoining flooded low land, resulting in numerous complaints from nearby residents.

A project consisting of three sections designed to correct the conditions described has been started. The first phase using 12-gauge Armco galvanized multiplate arch pipe has been completed. The proximity of two residences on the easterly side of the Mill Street culvert, set too low to permit adequate earth cover, dictated the use of a type of pipe other than the cylindrical reinforced pipe used to enclose other sections.

An arch design having a 76-in. span and 57-in. rise, formed of bolted corrugated plates, meets the situation very nicely. The cross-sectional area of the new pipe approximates that of the old stone culvert. The first part of the improvement completed early this year consists of 150 lineal feet of culvert extension.

The cost of the pipe was $3,449.17 with labor and equipment charges of $2,580.83. The total job cost was $6,030.00 resulting in an installed price of $40.20 per lineal foot.

Prior to installing the pipe, the brook channel was straightened and the bottom graded preparatory to spreading a 6-in. bed of No. 2 crushed stone. A small amount of grading in the rear yard of the adjoining house was required as compensation to the property owner for permitting the City to use a portion of his lot during the construction period.

Beginning at the existing culvert the bottom plate was placed on the bed of stone in the shallow water and the large headed bolts were inserted in the holes at the upstream end. Each successive bottom plate was carefully placed so that the bolts were projected through the companion holes ready to receive the nuts. When the bolts were properly set in the lowest plates the work of installing the balance of the arch rings was easily accomplished.

● **CULVERT extension completed, with part of backfill in place. At top, pipe being assembled on the ground.**

● FOAM at discharge from typical sewage treatment plant providing complete treatment; but no evidence of unusual foaming occurred in any unit.

SYNTHETIC DETERGENTS in WATER and SEWAGE

O. JOHN SCHMIDT,
Black & Veatch,
Consulting Engineers

THE USE of synthetic detergents increased from about 300 million pounds in 1946 to 1.6 billion pounds in 1954[3]. They are gradually replacing soaps in industrial as well as domestic cleaning operations and this trend is likely to continue but at a less rapid rate[13]. Various problems at water and sewage treatment plants have been attributed to the presence of synthetic detergents, often called "syndets." [2 3 6 7 8 13]. Recent investigations and studies have brought out new information on the properties of syndets as they are related to these problems.

There are three groups of syndets of significance in water and sewage treatment that are commonly employed: the anionic, primarily producing negative ions but also some positive ions; the cationic, primarily producing positive ions but also some negative ions; and the nonionic, producing no ions for all practical purposes.

Synthetic detergents are acid and hardness stable—that is, they function effectively over a wide pH range as well as in waters of varying hardness. They are excellent wetting, emulsifying, dispersing and deflocculating agents [10 11 13].

In general the surface tension of water may increase or decrease with the addition of solute. The more common salts tend to increase its surface tension while soaps and synthetic detergents decrease it. Agents which tend to decrease surface tension of water are more concentrated at the air-liquid surface and interfacial surfaces and are therefore said to be "surface-active" and are often termed "surfactants." Temperature of water also may affect its surface tension; a decrease in surface tension accompanies a corresponding temperature increase.

Lowering of surface tension due to any surface-active agent also appears to exert a bacteriostatic or bactericidal effect, and of the three groups of syndets being considered, the cationics seem to be particularly effective in such bactericidal or bacteriostatic action[2]. Dubos[4] has pointed out that the most powerful phenolic and arsenical antiseptics are those which are also the most surface-active[5]. In one European study the presence of synthetic detergents is reported to have increased the ability of penicillin to penetrate the protoplasm of *Proteus vulgaris*[9]. It would appear from this that perhaps by changes produced in the crganism cell wall surface-active agents may make certain disinfectants more effective. This raises the question of whether syndets also improve the effectiveness of chlorine as a disinfecting agent.

Synthetic detergents, for the purpose of this discussion, are considered to be products containing surface-active agents plus "builders." Builder compounds, intended to enhance the surface-active properties, represent about 60 percent of the weight of syndets and contain various phosphate compounds[13]. Sodium pyrophosphate ($Na_4P_2O_7$) and sodium triphosphate ($Na_5P_3O_{10}$) make up the bulk of the phosphates used, with the triphosphate being more commonly used. The proportion of builder compound used varies with the particular use to be made of the product.

The films produced by oriented surfactant ions tend to resist oxygen diffusion into the liquid, and this limits biological oxygen utilization. Holroyd and Parker[1] found that variations in the degree of depressing the rate of oxygen transfer depended both on the particular surface-active agent and concentration studied, and on the physical conditions of aeration. They concluded that the concentration of surface-active substance at the air-bubble interface appeared to form a barrier layer which impeded aeration. Kehr's work nearly twenty years ago showed that many substances normally found in sewage tend to lower surface tension and appeared to reduce atmospheric re-aeration rates[19].

Effects On Sewage Treatment

English investigators have observed indications that syndets in

sewage retard biological oxidation[13]. In addition, anionic detergents were found to increase the apparent BOD but to a degree which varied with the individual detergent[16]. Alkyl aryl sulfonates, which comprise the bulk of synthetic detergents in the anionic group, also present greater resistance to biological sewage treatment than do the alkyl sulfates[3]. This becomes more significant when considered in the light of the fact that the anionic is by far the most widely used of the three groups of synthetic detergents. Cationics are reported to decrease the apparent BOD of a synthetic sewage tested, but this effect is not found in sewage since the amount of anionic detergents used today far exceeds the amount of cationic detergent and has the property of neutralizing it[16].

Problems of sewage treatment attributed to syndets in sewage are reported to include: excessive frothing on aeration tanks[3]; increased BOD of settled sewage; increased suspended solids in primary tank effluents[6 8]; interference with the BOD test[16]; deleterious effect on a grease extraction process[6]; increased BOD in trickling filter and activated sludge plant effluents[7]; reduced biological activity due to bactericidal or bacteriostatic effect[2]; reduction in oxygen transfer rate in biological treatment and in receiving waters[13]; possibility of excessive concentrations of phosphates in receiving waters[13]; at certain concentrations, toxicity to fish[2]; and passage of certain syndets through sewage treatment plants with only about 50 percent removal[13]. Many of these effects vary in degree depending on the type and concentration of detergent predominating in a particular sewage.

To the extent that re-aeration ability of receiving waters is impaired, together with lowered sewage treatment plant efficiencies and increased phosphate content in effluents, syndets place a greater pollution load on streams as well as on water treatment plants utilizing such streams as sources of raw water. In addition, by impairing natural self-purification in streams through lowered reaeration ability, the effects of pollutional loads are extended farther downstream than they otherwise would be. Reversion of complex phosphates, which constitute a large proportion of many synthetic detergents, to less troublesome orthophosphates is possible but takes place very slowly in natural waters[17].

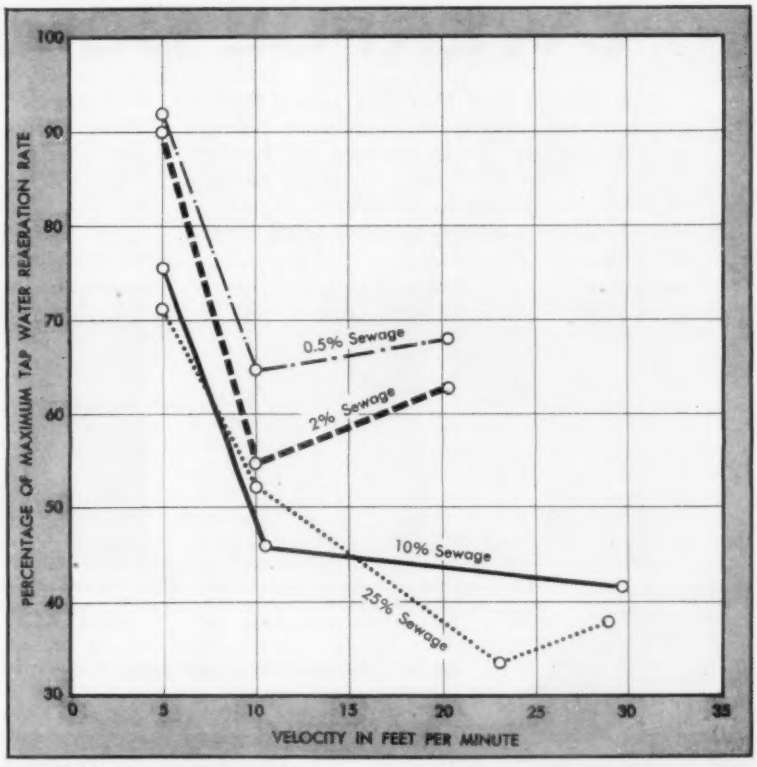
These problems of sewage treatment and disposal can be attributed to the various surface-active characteristics of syndets including: lowering of surface tension; action as deflocculating, bactericidal or bacteriostatic agents; and effects of phosphates in the builder compounds. It is possible that increased BOD's reported in certain sewage treatment plant effluents result from a combination of decreased biological oxidation in treatment, lowered efficiency of settling and the BOD exerted by the syndet itself. The biological interference which syndets cause emphasizes the necessity for correcting for the effects of synthetic detergents on the BOD test in any study of the influence of detergents on a specific sewage treatment process[16].

Problems in sewage treatment caused by synthetic detergents are sometimes difficult to detect. Foaming has frequently been associated with syndets but not always. Careful laboratory technique is necessary to correct BOD determinations for syndet interference. After applying such correction some operators have found effluent BOD's higher than normal. Efficiencies of biological treatment units in plants have also been found to be lower than normal; these are among the symptoms which should alert the operator for detergent problems. Control of these problems may include increased dosages of chemicals or lengthened aeration, where such treatment is employed, or increased periods of treatment, if plant capacity permits. At the Hyperion activated sludge plant in Los Angeles, a fifth air blower was needed because the increased use of synthetic detergents had correspondingly lowered the ability of the sewage to dissolve oxygen, according to a recent report.

Effects on Water Treatment

Past reports of difficulties experienced in water treatment attributed to synthetic detergents include: raw water foaming; higher dosages of coagulants required; interference with iron or manganese removal; tastes and odors; and foaming produced during washing of cation-exchanged softeners[3 18]. Recent studies have attempted to evaluate the separate effects of the surfactant and the builder portions of syndets on water coagulation. Howells and Sawyer[12] reported that surfactants alone had no effect on alum coagulation in water up to 10 ppm and that interference was due to complex phosphate compounds. The exact mechanism of the phosphate interference was not known. Smith, Cohen and Walton[17] found that tripolyphosphates and pyrophosphates

(*Continued on page* 189)



● **EFFECT of recirculation velocity on sewage-tap water mixture aeration rates.**

News BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Anderson Appoints Committees for 1957 Nominations, Service Awards and Resolutions

Chicago, Ill.—Robert L. Anderson, President of the American Public Works Association, recently announced the appointment of three important Committees. Edward J. Cleary, Executive Director and Chief Engineer of the Ohio River Valley Water Sanitation Commission of Cincinnati, O., was named Chairman of the 1957 Nominations Committee. Others named to this Committee were: Edward P. Decher, Secretary, Joint Sewer Commission, Newark, N. J.; John Morin, City Engineer, Oakland, Calif.; Walter Swietlik, Retired Commissioner of Public Works, Milwaukee, Wis.; and H. H. Stirman, Director of Public Works, Dallas, Texas.

Robert S. Hopson, Director of Public Works, Richmond, Va., was appointed to head the 1957 Resolutions Committee, which must pass on all proposed resolutions to be presented for consideration at the Annual Meeting of the Association, in Philadelphia, Pennsylvania, on September 22-25. Others appointed to serve on this Committee were: Hugo Erickson, City Engineer, Minneapolis, Minn.; C. M. Thelin, Director of Public Works, Fort Worth, Texas; and Ralph C. Graham, Superintendent of Public Works, Davenport, Iowa.

Samuel S. Baxter, Commissioner of the Water Department for the City of Philadelphia, Pa., was selected to serve as Chairman of the 1957 Samuel A. Greeley Service Award Committee. Carl Schneider, Consulting Engineer of New Orleans, La., and Edward Booth, City Engineer of Bismarck, N. D., were also appointed to serve on this Committee.

Five APWA Local Chapters Hold Mid-Winter Meetings

Chicago, Ill.—Nearly sixty members and guests attended a dinner meeting of the Manitoba Chapter, held at the Marlborough Hotel in Winnipeg, on January, 25. S. W. White, of the Civil Defense College of Arnprior, Ontario, explained what would happen in the event of a thermonuclear attack and told what should be done to minimize its effects. Some excellent films on Atomic and Hydrogen bomb tests were also presented.

Karl G. Heine, Secretary-Treasurer of the Northern California Chapter, reports that their January and February monthly meetings attracted large gatherings. I. W. Black, Resident Engineer for the California Division of Highways, was the guest speaker at the January meeting, and showed a color movie of the Cypress Street Viaduct construction project which consists of nearly 2 miles of double deck viaduct providing 4 traffic lanes in each direction. The February meeting featured the presentation of a film "Trash To Treasurer" by E. E. Westerback, of the International Harvester Company. The film shows the sanitary-landfill operations conducted by the Public Works Department of Tampa, Florida.

The New Orleans Chapter of the APWA held its February meeting at the Gas Department Auditorium of the New Orleans Public Service Corporation. The guest speaker was Victor Wogan, Jr., Director of the Department of Property Management of the City of New Orleans. Chet Mozena, Secretary-Treasurer of the Michigan Chapter reports that the featured speaker at their February meeting, which was held at Huck's Inn near Detroit, was George Foster, Chief Engineer of the Michigan State Highway Department. Louis R. Inwood, Deputy Director for Aviation of the Philadelphia International Airport, was the speaker at the January meeting of the Philadelphia Metropolitan Chapter which was held at the Engineers' Club of that City.

Over 100 Attend North Carolina Municipal Public Works Conference

Raleigh, N. C.—More than 100 persons attended the third Annual Municipal Public Works Conference held in Raleigh, N. C., on February 21-22, 1957. The Conference was sponsored by the North Carolina League of Municipalities and the Civil Engineering Department of North Carolina State College.

S. Leigh Wilson, Assistant Executive Director of the Municipal League, presided at the opening session which included introductory remarks by Professor W. F. Babcock of North Carolina State College; a discussion on "Training Public Works Personnel" by Robert D.

Bugher, Assistant Director of the American Public Works Association, Chicago; and a talk on "Public Works Records" by J. D. Wright, Director of Public Works, Lynchburg, Va.

After the noon luncheon the conferees heard Professor Carrol L. Mann Jr., of North Carolina State College speak on "Construction Practices, Specifications, and Contractual Relations." This was followed by an excellent discussion on the design and construction of asphalt pavements by D. D. Dagler and R. K. Williams, Jr., of The Asphalt Institute and a film "Heavy Duty Streets With Hot Mix Asphalt" was shown.

The evening session was devoted to an organizational meeting of the North Carolina Chapter of the American Public Works Association. H. W. Kueffner, Director of Public Works of Durham was elected as the Chapter's first President. Vern Peebles, City Engineer of Raleigh, was elected Vice-President and Leigh Wilson was named Secretary-Treasurer. Others elected to serve on the Executive Committee were: R. W. Neilson, Director of Public Works, Winston-Salem; Professor W. F. Babcock, North Carolina State College; R. T. Nichols, City Manager, Mooresville; and Leonard P. Bloxam, City Manager, Greenville.

The second day's session featured a talk on "Street Construction Equipment" by M. A. Meares, Vice-President, A. E. Finley & Associates, Raleigh, and a discussion of earthwork construction by Professor C. Page Fisher, of North Carolina State College. This was followed by a discussion of soil cement and concrete construction practices by W. R. Pulley and A. L. Meisel of the Portland Cement Association. The concluding portion of the conference program covered the use of calcium chloride in constructing and maintaining municipal streets by M. C. Adams of the Calcium Chloride Institute.

Headquarters Seeks Information on Public Building Management

Chicago, Ill.—Several members in attendance at the session on the Management of Public Buildings and Grounds at the 1956 Public Works Congress expressed an interest in establishment of a clearing house for information on the management of public buildings and grounds. The Board of Directors of the APWA, at a recent meeting in Chicago, decided that the headquarters should

therefore take immediate steps to build up a file of information on this subject so that it would be available for distribution to members of the Association on a loan basis.

It is requested that copies of any reports, manuals, etc., on this subject, including record forms, accounting and budgeting information, be sent to the headquarters at 1313 East 60th Street, Chicago 37, Illinois, as soon as possible. References to such material would also be appreciated. If sufficient information is received a bibliography on this subject will be prepared for distribution to the membership.

Candidates Being Considered for Education & Achievement Awards

Chicago, Ill. — Nominations are now being accepted for the 1957 Charles Walter Nichols Award, which is annually presented to a member of the Association in recognition of outstanding and meritorious achievement in the broad field of sanitation, including: refuse collection and disposal, street sanitation, sewers and sewage treatment and water purification and distribution. The award consists of an honorarium of $500.00 and a scroll describing the achievement. Any member may nominate a candidate for the award by writing a letter to the Nichols Award Committee, in care of the headquarters in Chicago. The letter should briefly describe the achievement. Further information will thereafter be requested from the nominees for the award. All candidates must be active members of the American Public Works Association and engaged in full-time employment by a municipal government.

The recipient of the Award will be selected by a Committee composed of: George Sandenburgh, Superintendent of Public Works, Ann Arbor, Mich., Chairman; Warren A. Coolidge, Retired Director of Public Works, Nashville, Tenn.; and Morris M. Cohn, Editor, Wastes Engineering, New York, who was recently appointed to this Committee by President Robert L. Anderson.

Applications are also being received for the 1957 Engineering News - Record Aid - To - Education Award. For the past two years the publisher of this magazine has made available a $1,000 cash award for advanced study in the broad field of public works engineering and administration. This year, the eligibility requirements were changed so that the award is available to help

finance a student's senior year of undergraduate study or to finance partially advanced study in this field by a graduate of an accredited engineering college or university.

The winner of this year's award will also receive an all-expense paid trip to the 1957 Public Works Congress and Equipment Show, in Philadelphia, September 22-25, at which time the award will be formally presented. Applications must be submitted on forms available from the American Public Works Association prior to June 1, 1957.

The recipient of the award will be selected by an APWA Committee composed of Jess D. Gilkerson, City Engineer, Long Beach, Calif., Chairman; Henry D. Harral, Supervisor of Municipal Assistance, Institute of State and Local Government, University of Pennsylvania; and John G. Thompson, City Engineer of Madison, Wisc., who was recently named to this Committee by the President of the Association. The selection will be based on a rating system which takes into account scholastic capacity, demonstrated ability on a public works job, personal qualities and the relative excellence of a paper written about a public works project with which he has been connected.

Special Report Available on Training Public Works Employees

Chicago, Ill.—A resolution adopted by the membership at Milwaukee in October, 1955, called for the establishment of a Committee to explore ways and means of assisting public works organizations in connection with their training and staffing problems. Such a Committee was appointed in January, 1956, and recently completed its assignment. The findings of the Committee are included in a 51-page Special Report titled—"Training and Development of Public Works Employees," which was recently approved for publication by the APWA Board of Directors. The price of this publication is $2.00 per copy. Members are entitled to the usual forty percent discount.

S. G. Gentile, Administrator of the Department of Public Works of Detroit, Mich., who served as Chairman of this Committee, made the following comments in his letter transmitting the report to the Board of Directors:

> "It seems quite apparent to the Committee that public works organizations, in general, are not devoting sufficient attention to the training and development of their employees. The report, therefore, includes a discussion of why training is important and stresses the fact that the primary responsibility for correcting this situation rests with the administrative and supervisory officials of such organizations. Various types of training programs that might advantageously be used in the public works field are also discussed in the report.
>
> "Special attention was likewise given to the problem of recruiting competent persons to fill important positions within public works organizations. Inadequate salaries and the lack of well-established career lines are two of the major obstacles that must be overcome if local government, in particular, is to be successful in attracting and recruiting well-qualified personnel. However, the Committee's report suggests several steps that might be taken to help alleviate the recruitment problem."

Other members serving on the Committee which prepared this report were: Henry D. Harral, Institute of State and Local Government, University of Pennsylvania; Reed McKinley, Director of Public Works, Kansas City, Mo.; Robert C. Garnier, Assistant Personnel Director, Milwaukee, Wis.; W. C. Wichman, Director of Public Works, Cincinnati, O.; F. A. Chworowsky, Director, Bureau of Personnel, Department of Public Works, Los Angeles,

Calif.; Robert S. Hopson, Director of Public Works, Richmond, Va.; Charles S. Goode, Assistant Director, Department of Public Works, San Diego County, Calif.; H. H. Stirman, Director of Public Works, Dallas, Texas; and W. E. Parker, City Engineer, Seattle, Wash.

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Emil Kaleschke of Oakland City Engineer Office Retires

AFTER THIRTY-THREE years in the office of the City Engineer of Oakland, Calif., Emil Kaleschke retired on April 1. His friends and associates honored him with a farewell dinner on April 4. Mr. Kaleschke joined the department as draftsman and progressed through the various grades to Supervising Civil Engineer. During his work with Oakland, he supervised the expenditure of more than $10 million on public works construction. He has also been active in technical societies. He was active in forming the Northern California Chapter of APWA and served as president in 1949. He received from APWA the 1955 Samuel A. Greeley award in recognition of his long and outstanding service with Oakland. He has served on many local civic and community groups and is outstanding in the esteem of the local community.

Mr. Kaleschke

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Francis E. Daniels Retires

Though still going strong Francis E. Daniels, well known in the sanitary engineering field, has retired. Back in 1907, he carried on at Red Bank, N. J., the famous experimental work on the treatment of sewage with chlorine, a start on the present wide-scale usage of that chemical in many forms of water and sewage treatment. He was state sanitary engineer of New Jersey before going to the Pennsylvania Dept. of Health in 1916.

He served in World War I and it was hard to keep him out of World War II, but age limitations prevented him from serving. For many years he attended the summer training camps at Carlisle, Pa., where he usually served as drill instructor, for which he had a high talent. He was accomplished in many fields of endeavor, from Latin and Greek to glass-blowing and blacksmithing.

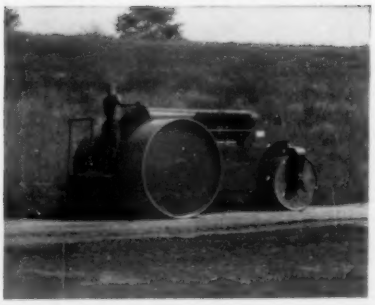
He was Director of the Chemical Laboratory of the Pennsylvania Dept. of Health for some 30 years. His service has been as outstanding as his spirit. Though retired, we expect to see him at the coming conventions, exhibiting his usual zest and enthusiasm.

• • •

Houston Engineers Employ Henry Wilkens

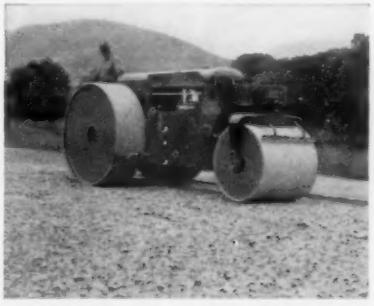
Henry Wilkens, Jr., formerly District Manager of the Texas Water Co., at Houston, Texas, is now with Freese, Nichols and Turner, Consulting Engineers of Houston. A graduate mechanical engineer from Rice Institute, Wilkens has been recognized as a past chairman of the Southwest Section, A. W. W. A. and as program chairman for that organization for a number of years. He has likewise served the Texas Water and Sewage Works Association in a number of official assignments. His engineering experience record includes several years as Superintendent of the Galveston, Texas, Water Dept.

Buffalo-Springfield 3-Wheel Roller on a widening and bituminous resurfacing job.



This 3-Wheel Buffalo-Springfield Roller is compacting earth fill for new pavement.

Buffalo-Springfield 3-Wheel Rollers speed compaction on fill consisting primarily of slate refuse from a coal mine.



Here a Buffalo-Springfield 3-Wheel Roller compacts crushed stone base for new highway.

To compact largest *variety* of material, use Buffalo-Springfield's 3-Wheel Roller

Buffalo-Springfield Heavy-Duty 3-Wheel Rollers are long-time favorites for handling the wide variety of materials found in fills, subgrades and bituminous pavements. Variable weights in 10-14 and 12-15 ton sizes, power roll brakes, tapered roller bearings on *all* rolls . . . assure widest range of use, unequaled safety, maximum maneuverability, smoothest performance and longest operating life.

The Buffalo-Springfield 3-Wheeler's time-proven 4-speed transmission is an unmatched assembly built for outstanding performance and durability under severe load conditions. Torque converter drive with 2-range transmission is also available as optional equipment.

When *one* roller must do *many* jobs, the Buffalo-Springfield 3-Wheel Roller is your best buy. Ask your nearest Buffalo-Springfield distributor today for all the reasons *why* Buffalo-Springfield 3-Wheel Rollers are top choice for multi-purpose compaction regardless of the type of material to be compacted.

Write today for a copy of the new 3-Wheel Roller Bulletin, S-72-156.

BUFFALO-SPRINGFIELD ROLLER CO.
DIVISION OF KOEHRING COMPANY · SPRINGFIELD, OHIO

Can You Spare Back Copies of Public Works?

An attempt is being made to build a sanitary engineering library for Haiti. Our readers are asked to donate copies of issues of Public Works prior to 1952 to the University of Haiti. We are informed that these may be sent to Le Harve Transportation Co., 36 Water St., New York 5, New York; but having a wholesome regard for our reader response we suggest writing to Le Harve first to assure that they are not overwhelmed. These back numbers are requested by A. E. Williamson, Service Cooperatif Inter-Americain de la Sante Publique of Haiti. We hope it will be possible to aid this worthy project. Copies may be sent collect to Le Harve.

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Fleet Superintendent Position Desired

National Service Manager for Major Automobile Manufacturer interested in acquiring position as Fleet Superintendent city or county. Background includes supervision of present organization, service engineering passenger cars and trucks, field service work, management of truck factory branch service and parts department. During war Supervisor of maintenance and overhaul of aircraft engines for Air Force. Past experience and present close association with police and municipal fleets would assure proper selection of equipment and lowest possible cost of operation. Address Box RB4, Public Works Magazine, 200 So. Broad St., Ridgewood, N. J.

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Photogrammetric Engineering Course

The Massachusetts Institute of Technology will present a special summer course in photogrammetric engineering during the two-week period July 15 to 26, 1957. The course is designed for practicing professional engineers interested in reviewing the underlying principles and basic theory of photogrammetry and the modern developments in applied photogrammetry. Emphasis will be placed on photogrammetric theory and practice as related to the planning, location, and design of civil and highway engineering projects.

A brochure giving complete information on the course may be obtained from the Office of the Summer Session, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

• • •

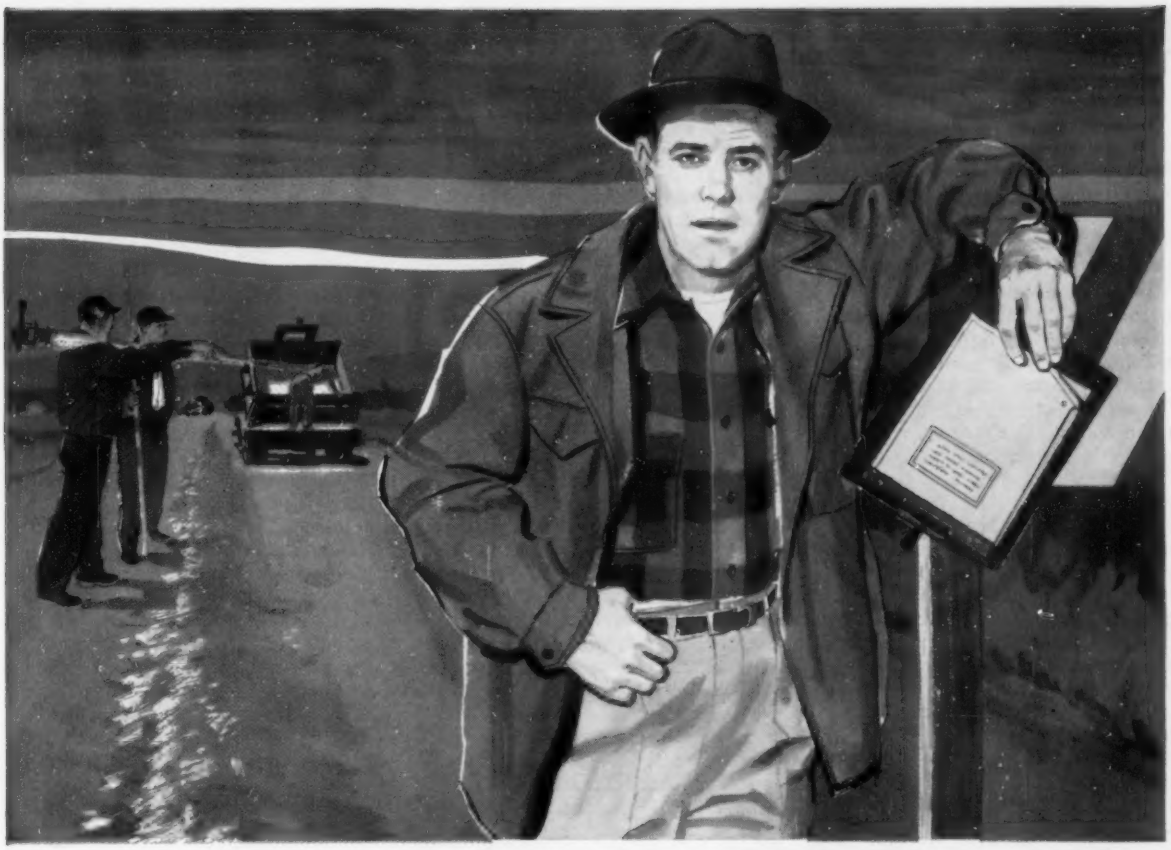
Air Pollution Control Meeting

St. Louis will be host to the Air Pollution Control Association's Golden Jubilee Meeting, June 2-6, 1957. Among scheduled topics are Municipal Odor and Indoor Odor Control; Motor Vehicle Exhaust—Its Nature and Method of Control; Air Pollution Problems in Power Plants; An Improved Smoke Inspection Guide, and Performance Standards in Air Pollution Zoning.

• • •

Prefabricated Metal Building for County Garage

A new garage has been constructed by Montgomery County, N. Y., using prefabricated metal. The building is 40 by 60, with a concrete floor and heating. Cost of the building, which was a product of U S Fabricators, was $5,690, and the completed job cost was $14,516. Insulation will be placed in the building during the coming year. Storage is provided for five or six regular trucks or three snow plows. Heating is by suspended unit type gas heaters.



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HIGHWAY FUNDAMENTALS

BEN H. PETTY, Professor of Highway Engineering, Purdue University

Abstracts from a paper presented at Wisconsin Road School, Milwaukee, Wisconsin, January 24, 1957

ONE OF the most serious handicaps, on both local and state highways, involves the apparent necessity of trying to build and maintain a modern motor vehicle highway within the confines of a "horse and buggy" right of way. We often do not have elbow room to do the job right. In Indiana, in the old days, local road rights of way were set at two rods. This 33-foot width still prevails on thousands of miles of our county and secondary state roads. Certain of these county roads were taken into our state highway system many years ago but too many of them are still operated in the original confined right of way or within an additional 10- or 20-foot width as prescribed in earlier days of state highway work.

I am urging our county men to refuse to blacktop or stabilize in any manner until the landowners will grant at least a minimum of 50 feet of right of way. On relocations, the landowner should be paid reasonable right of way costs. The motorist pays the entire cost of highways in Indiana with the minor exception of property tax bridge levies developed in some 46 counties. The motorists traveling city streets and state highways therefore pay the major share of the bill on local roads. Rural dwellers who want their roads stabilized should be willing to provide an additional strip of 5 or 10 feet of right of way within which to build a dust free road.

Alinement—It would have meant "money in the bank" if we could have established the original vertical and horizontal alinement of our highways according to today's standards. However, we cannot be too critical of those men who laid out our highway alinements 30 to 50 years ago since they could not have foreseen the present volume, speed and type of traffic. It is obvious that reconstruction of existing roads, or complete relocation, should be based on our best knowledge of vertical and horizontal alinement needs.

This fits in with the advantages of stage construction whereby, with adequate alinement and width of grade, we can start, if desirable, with a low-cost surface and gradually step this up to a high-type surface as traffic demands. In this way, our surfacing investments are conserved.

Base—Full utilization should be made of our current knowledge of soils through test borings and laboratory analyses to determine whether or not we have an adequate foundation to carry the highway loads. Obviously, adequate compaction of embankments and recompaction to a reasonable depth in cuts will pay big dividends. With the tremendous advancements in excavating and earth-moving equipment, we are no longer compelled to seek a balance of cut and fill on any highway project: the balancing of cut and fill is only incidental in securing desirable vertical alinement and good drainage. Some jobs, on level terrain, might call for 100 percent fill, necessitating complete borrow in order to get a high-level grade line for drainage purposes and natural snow removal.

In the past we have frequently overlooked the fact that the surfacing material of gravel, stone, bituminous mixtures, portland cement concrete and so forth are primarily wearing surfaces, all of which transfer the loads carried to the subgrade or foundation material. The underlying earth eventually carries the load and its stability should be assured before we invest very much money in a wearing surface.

Drainage—Water is public enemy No. 1 for highways. Water on the surface, in the road surfacing itself and in the subgrade causes trouble. An earth road is stable when it is dry and unstable when it is wet. Therefore, any drainage provisions we can install to get water off our highways and keep it out of the surfacing material and the subgrade will obviously tend to stabilize that road. This calls for a surface crown, conforming to the type of surface used, with sloping shoulders always maintained at, or slightly below, the pavement edge. Adequate side ditches must be provided and maintained at a proper hydraulic gradient to carry the surface run-off to a convenient discharge point and not to pond it alongside the road. In many cases sub-drainage should be provided to lower the ground water table under the highway thus preventing saturated subgrades and eliminating frost heaving.

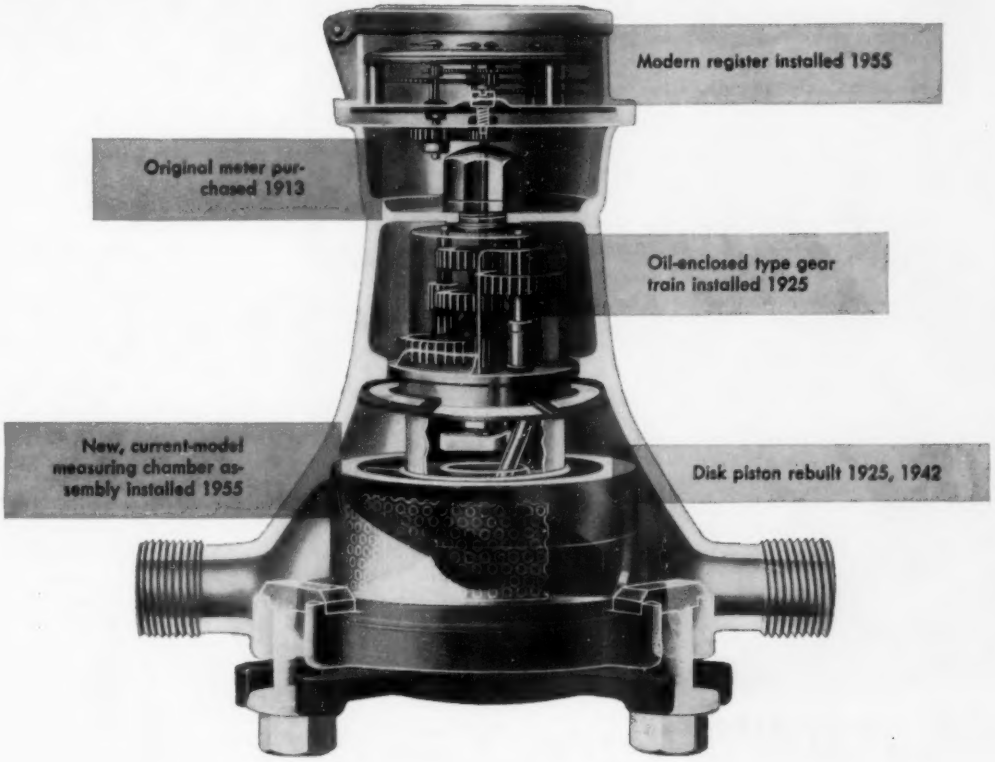
In connection with subdrains, the backfilling material in the trench should not be limited to coarse stone or gravel. The voids in such will soon be plugged by sloughings from trench sides. The ideal gradation curve for this backfill material would be difficult and expensive to provide in many localities. A pit-run gravel, well graded from top size down to fine sand, will work very well. Another solution is to use concrete sand as trench backfill over the drain pipe.

A drainage obstacle that is frequently overlooked or neglected is that of high shoulders. Usually this neglect is more in evidence along local roads than on state roads though glaring examples can be found on the latter. I have seen county gravel and stone roads where the shoulder was as much as eight inches above the wearing surface. Part of this is due to the wearing down of the aggregate faster than it has been replaced and part is due to the gradual build up of the shoulder from accumulation of dirt and sod. Even on state highway pavements, shoulders are frequently from one to three inches too high. In either case, these high shoulders tend to pond water on the road surface during heavy rainfalls producing a traffic hazard. With unstabilized surfaces and cracked pavements it permits the water to penetrate through to the subgrade, thus increasing instability. The usefulness of side ditches is greatly reduced if the water which falls on the road surface cannot cross the shoulders to reach them. Stabilized shoulders usually eliminate this drainage problem. Unstabilized shoulders require prompt maintenance. That high-level, sodded shoulder may look beautiful, but in the interest of traffic safety and roadway stability it should be eliminated whenever necessary.

Road Surface—The type of road surfacing material to be selected depends upon such things as volume and weight of traffic, availability of local materials, funds and the over all importance of the highway. In the case of unstabilized gravel or crushed-stone roads, if only one specification is to be written it should contain a rigid control on the top size of aggregate used. It is my feeling that for such road surfacing all of the aggregate should pass a ¾-inch screen. It will help if the aggregate is well graded from this top size right on down to the finest particles. However, we are considering a low-cost road surface and you cannot get a low-cost surface by writing tight specifications. We are using pit-run gravel with all oversize particles crushed to pass the ¾-inch screen or we are using crusher-run stone passing the ¾-inch screen. It is a waste of good aggregate if we throw away all gravel particles retained on the ¾-inch screen, and it may be good policy to add a crushing operation if the oversize exceeds 10 percent.

The old idea that you can't have a good gravel or stone road without "big stuff" on the bottom is out dated. Sooner or later, through failure to replace the finer surface aggregate, or from frost heave, we will have those big stones on top, making it impossible to blade a smooth surface and presenting a rough riding surface with excessive wear and tear on tires.

As traffic increases and blade maintenance costs become excessive, we should resort to some form of stabilization, but not until we have built up a thickness of aggregate adequate to carry this more costly surfacing without breaking up in the spring. Much money has been spent on surface stabilization of gravel or stone roads only 4 or 5 inches thick. An adequate base and good drainage



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are necessary before surface stabilization. As in the case of high-type pavements, the stability of what is under the pavement insures the conservation of our investment in the surfacing material itself. It is poor economy to acquire adequate base thickness by six or eight repeated applications of more costly bituminous surface treatments.

Width of Surfacing—In this age of high speed motor vehicle traffic, I question the advisability of surfacing any road with less than a two-lane width. With intermediate-type bituminous surfacing the width should be adequate to prevent running off the pavement edges by the outer wheels when vehicles pass. This starts edge raveling and tends to develop ruts along the pavement edge which not only trap water to soak into the subgrade but present a most dangerous traffic hazard. Even on local roads, with intermediate to high-type surfacing, the lane width should be a minimum of ten feet. On state roads, the minimum lane width should be twelve feet. This is about a maximum also, since if we go much beyond a 12-foot lane width, some motorist sooner or later will try to make a three-lane pavement out of a two-lane pavement.

Structures — The most serious problem faced by highway engineers is that of narrow, weakened, poorly alined and generally inadequate bridges and culverts. Some of these were built 40 to 50 years ago, designed for light weight traffic and throughout their lifetime have received little or no maintenance. You cannot judge the stability of a bridge by riding over it. You must "get out and get under." The parts of a steel structure to check first are the footings on the abutments and piers and the stringers and floor beams under the floor. Another hazard to all bridges is underscoured abutments and piers. Narrow structures are killing motorists almost every day. We often have widened pavements until there is no safety clearance left.

• • •

Foaming of Aeration Tanks Presents Problem

Frothing or foaming on the surface of the aeration tanks has been a problem at the Cranston, R. I., sewage treatment plant. At times, a blanket of foam ten feet or more in depth has covered the aeration tanks. Plans have been prepared, according to the annual report, for an effluent spray system and for the use of a small amount of defoaming agents. Walter C. Anderson is Plant Superintendent.

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PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Extraction of By-Products from Sewage Sludge

A pilot plant was established at the Rockford, Illinois, Sanitary District sewage plant to treat one-third of the sludge from the plant. The treatment process developed, called the McDonald Process, consisted of dehydration of the sludge by centrifuging in the presence of a solvent, perchloroethylene, followed by distillation in a dehydrator at 215°F. During the distillation process, water vapor is driven off and the bulk of the solids are dissolved in the solvent. The resulting solution is separated from the non-extractible material and filtered with the aid of diatomaceous earth in a rotary vacuum filter. The filtrate is passed to stills where the concentration of solids is increased from 2 percent to 95 percent. It is then subjected to a stripping column for solvent removal and recovery of "black fat." The filter solids together with the non-extractible material are compacted and returned to the dehydrator. The "meal" from the dehydrator is fibrous, containing about 20 percent moisture. The solvent and water vapor are continually cycled, with periodic separation of the solvent for re-use The by-products are the dried solids, the oils and fats. While time required for sludge handling by this process is reduced to a few hours and saving in space requirements is considerable, this saving and the demand for by-products is not sufficient to offset the expense of treatment at the present time.

"Treatment of Sewage Sludge by the McDonald Process." By R. H. Stolley, Hills-McCanna Co., and E. H. Fauth, Barber-Greene Co. PUBLIC WORKS, March.

Design Data for Turnpike Service Centers

Designing sewage treatment plants and water systems for turnpike service areas, motels, drive-in theaters, supermarkets and shopping centers is becoming a more frequent task for engineers, yet design data have been lacking. A survey of state sanitary engineer opinions indicated uniform concepts of the problem with regard to motels and trailer courts where anticipated water use is about 50 gpcd. For different types of rest areas, such as public comfort stations, service station rest rooms, and picnic area toilet facilities, 5 to 10 gals. per person was estimated. Drive-in theaters were rated on a "per car" basis, 2 to 7½ gals. Restaurant design factors showed the greatest variation in both basis and data; however, most of the engineers preferred estimating water use by the meal served. By this criterion, water use estimates ranged from 2½ to 10 gals.

"What Is the Water Use and Sewage Volume of the Public Away from Home." PUBLIC WORKS, March.

Sewage Plant Designed for Residential Compatibility

Built in a highly developed residential area, the Sacramento, Calif., sewage treatment plant has been designed and operated to minimize aesthetic objections. The treatment consists of prechlorination, grit removal and washing, comminution, preaeration, settling and post-chlorination. Sludge is digested, elutriated, flocculated and dewatered on vacuum filters. Preaeration and settling are accomplished in the same structures, with air introduced in the front portion of the basins. The effluent from this process carries 4 ppm dissolved oxygen. Flocculation of the sludge is effected with ferric chloride.

"Sewage Plant Is Attractive Community Enterprise." PUBLIC WORKS, March.

New Primary Plant at Lynchburg

A $4 million sewerage and sewage treatment plant construction project is to be financed by means of a 20-year bond issue to be retired by revenue from a 75 percent increase in water rates. The improvement program will include 20 miles of new sewers and a primary treatment plant. Secondary treatment is included in the plans, to be built as exigencies might require. Treatment units consist of mechanically-operated bar screens, grit collector and washer, an aerator-clarifier, a final clarifier, a chlorine contact chamber, primary, and secondary digesters, and a coil-spring vacuum filter. The sludge is to be flash-dried and sold.

"Primary Plant Can Be Doubled

Power Equipment Speeds Utility Work

● **EXTENDING utility lines in Waukesha, Wisc. Here is a city-owned Bucyrus 15-B power shovel teaming with a ¾-yd. 22-B clamshell, shown in the background.**

in Size and Supplemented by Secondary Units." By R. B. McNutt, Jr., Wiley and Wilson. *Wastes Engineering*, February.

Biosorption At Tulsa

The "Biosorption" process was chosen for the new Flat Rock Creek Sewage Plant at Tulsa, Okla., because of low construction cost, slightly lower operational cost than activated sludge, and because of lack of "traveling odors" from operation. The treatment system involves screening, grit removal by the Griductor, aeration for one hour in the presence of activated sludge, and clarification for 2 hours. The collected sludge is recirculated to the aeration basins for a 4-hr. stabilization period. The primary digester is heated to 93°F; the secondary has a floating cover. The DO in the mixed liquor is held at 2.6 ppm, and that in the effluent is about 1.2 ppm. Air supply rate is maintained between 1.3 and 1.5 cu. ft. per gallon. BOD reduction averages are 108 ppm from a raw sewage value of 128 ppm.

"'Stepped-Up' Activated Sludge Plant Built at Low Construction Cost." By Allan Craig, Wood and Craig. *Wastes Engineering*, Feb.

Other Articles

"Unattended Pumping Station Solves Lake Pollution Problem," at Worcester, Mass. By W. H. Brackett. PUBLIC WORKS, March.

"Transistors Watch Over 13 Sewage Pumping Stations," at Glen Cove, N. Y. By Harland H. Phillips. PUBLIC WORKS, March.

"Sewage Salinity Prevents Use of Effluent for Golf Course Irrigation," in Coronado, Calif. By B. E. Guymon. *Wastes Engineering*, February.

"Sewage and Industrial Wastes in 1956," a review of developments and trends. By Emil C. Jensen. *Water and Sewage Works*, February.

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Sewage Treatment Plants and Needs in Indiana

There are 126 sewage treatment plants in Indiana, including those under construction. These serve over 80 percent of the urban population according to a report of the Indiana Water Resources Study Committee. Only 7 of the 39 cities over 10,000 are not served by sewage treatment plants. In the 2,500 to 10,000 population group, there are 56 muncipalities with sewage treatment and 20 without treatment. There are 38 sewage treatment plants serving communities with populations under 2,500. In this bracket there are 118 communities with sewers but no treatment.

There are about 20 municipalities served by sewage treatment plants that are inadequate and many other plants are nearing their design capacity. In addition, sanitary and storm relief sewers are needed within the corporation limits and in the fringe areas in most all localities. Extension of sewers to these areas will require sewage treatment plant expansions.

• • •

Mosquito Control by City-Wide Spraying

Though an initial spraying, made some three years ago in Albert Lea, Minn., was ineffective in controlling mosquitoes, a second spraying, which covered almost the entire city, gave excellent results. Control lasted three to four weeks and might have been effective longer except for heavy rains. Spraying has been continued. Two men operate the sprayer and it takes about three evenings to cover the entire city. Rochester, Minn., sprayed breeding areas, but had no city-wide program. New Ulm reported excellent results from a program financed by general funds instead of assessments.

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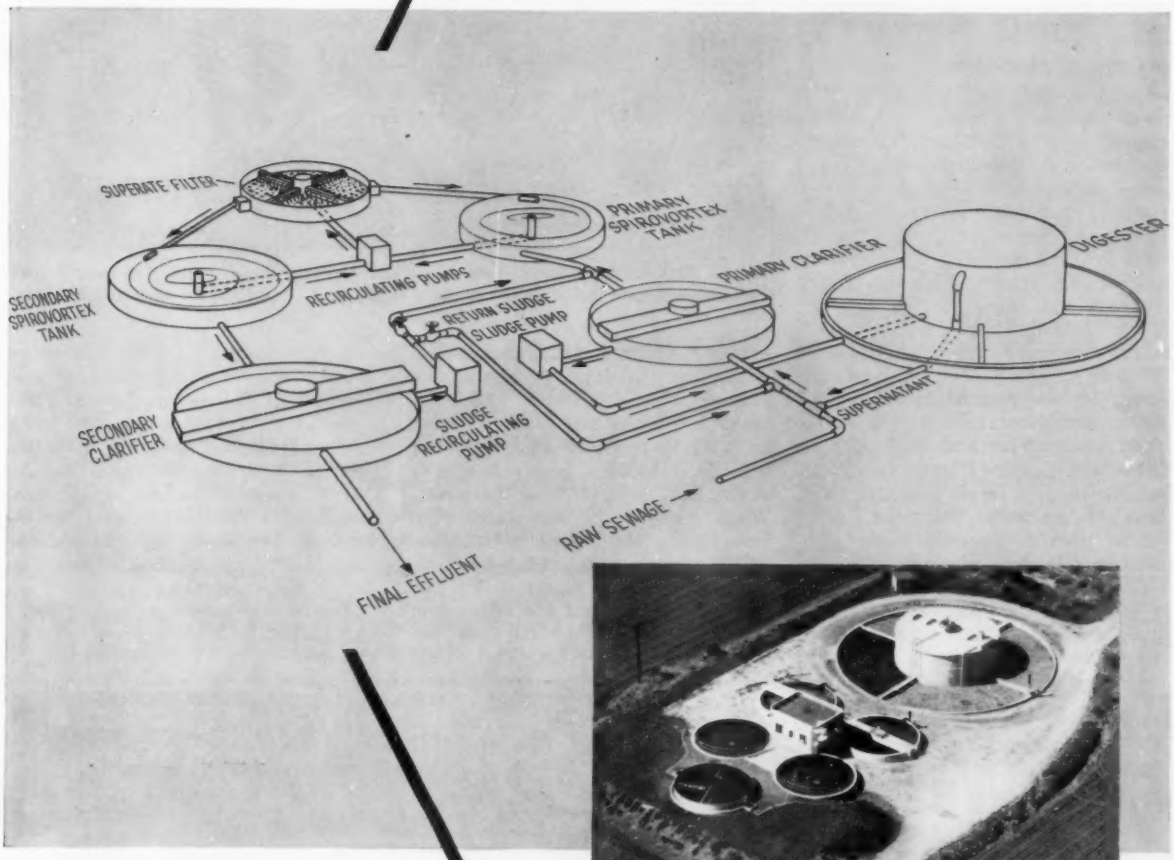

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For a more complete picture of how the new Dorr-Oliver SpiroVortex System operates, write for a copy of Bulletin No. 7314 — just off the press. Dorr-Oliver Incorporated, Stamford, Connecticut.

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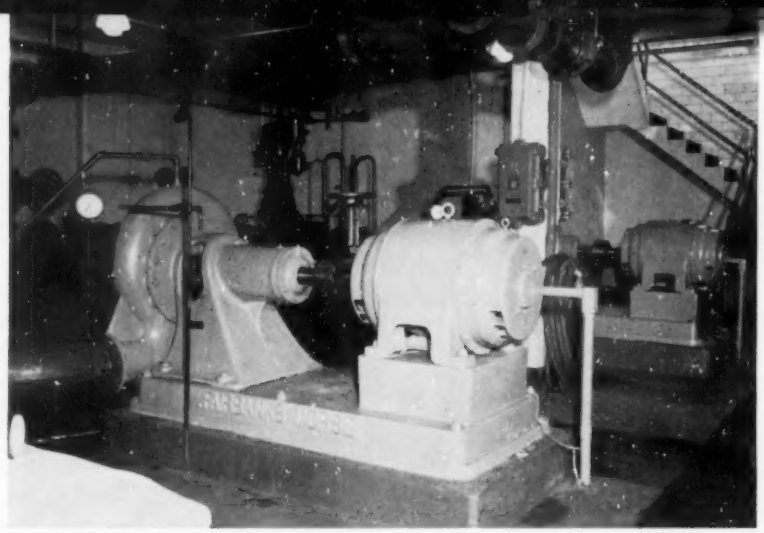

● AT THE Linden-Roselle Sewage Authority plant, these 8-inch Fairbanks-Morse centrifugal pumps move sludge through 4,000 feet of force main to a loading dock.

SLUDGE DISPOSAL at the Linden-Roselle Sewage Authority plant in New Jersey presented somewhat of a problem. Industries in Linden contributed wastes that made biological treatment by digestion difficult or impossible. Therefore, the plant designed and built in 1952 provided for disposal by barging at sea. This involved pumping the sludge through 4,000 ft. of 24-inch force main, using Fairbanks-Morse centrifugal pumps. Prior to pumping to the barge, the sludge is concentrated in two covered concrete storage tanks, each 58 ft. in diameter and 22 ft. deep. These are provided with facilities for stirring, recirculation and removal of free water, using the same pumps that deliver the sludge to the barge loading platform.

The 24-in. force main terminates in two 12-in loading hoses, each 20 ft. long, which are controlled by gate valves. During the loading operation, sludge samples are taken each time the level in the sludge storage tank drops one foot; and when the tanks are pumped down to the 7-ft. level, effluent from the plant is introduced to break up the sludge in the bottoms of the tanks. When pumping is completed, the force main is flushed with plant effluent for 15 minutes, the time required for fluids to reach the far end of the line; and the effluent is then allowed to flow back to the plant for recirculation. The loading job is done at intervals of three weeks. The two centrifugal pumps, operating alternately, move 3,500 tons of sludge through the force main to fill the barge in 5 hours. Sludge from the Rahway, N. J., plant is also disposed of through the Linden-Roselle barging facilities. A 3-mile force main brings about 3,000 cu. ft. of sludge daily to the storage tanks.

Charles Saunders is superintendent of the Linden-Roselle treatment plant.

● TRACTOR and spreader distributed nearly 3 tons of seed.

● WOODEN float breaks up clods and fills minor voids.

● FLOAT and "Cultipacker" prepared the smooth fairways.

Seeding a Golf Course: DO-IT-YOURSELF *Saves Money*

GEORGE F. BURNLEY

EXTENSIVE cost estimates and surveys indicated that the City of Alameda Engineer's Office could save a substantial sum over bids by private contractors in seeding a 50-acre nine-hole addition to the existing municipal golf course. Seeding of the first nine-hole portion of the new eighteen-hole course last winter and spring had cost $34,863. However, present bids (which the City Charter required) showed the lowest bid to be in the neighborhood of $23,000. By using advanced techniques, modern equipment and economical planning, plus the know-how gained from earlier experience, the Engineer's office estimated that the cost could be pared to about $16,000.

The area to be seeded consisted of nine gently rolling fairways, a driving range and a practice putting area, all recently graded over marshy tidelands by a private contractor. (For detailed description see PUBLIC WORKS, May 1956, Pg. 155). The soil, which has a very high clay content was then sprinkled with lime. As an additional agent to keep the soil loose and uncompacted, the greens were sprinkled with Kirilium; during and after planting of seed an ammonia-phosphate type fertilizer (Pacific Guano) was worked into the soil. Also, to stimulate the new seeds, sand and manure were spread on greens prior to planting. As opposed to the importation of topsoil which was done on previous occasions, experience has shown that treatment of native ground gives equally satisfactory turf, has fewer weeds, and is cheaper.

Discing of the area prior to fall grass planting was accomplished on a contract basis by a local farmer. A D4 Cat which is part of the existing course equipment dragged a 6 x 8-foot wooden float over the area to level minor high spots and fill voids. A "Cultipacker" pulverizing roller is kept at hand for occasional use when needed and a Ford tractor with a Gill seeder is being used for planting the seed. On-the-job personnel consists of one engineer plus two laborers hired on a temporary basis.

The fairways undergoing planting receive 80 percent Meadow Fescue and 10 percent of Highland and Astoria Bent grass seeds, respectively. The rate of planting runs at about 2½ lbs. of seed per 1,000 sq. ft. The rapid growth of the Meadow Fescue shades and protects the bents which take longer to germinate and which eventually crowd out the host to take over the area entirely.

The greens and green aprons are planted with Seaside Bent at a rate of 2 lbs. of seed per 1,000 sq. ft. "T" 's require 3 lbs. of hulled Bermuda seed per 1,000 sq. ft. The apparent discrepancy in the above rates results from the relative difference in the sizes of the individual seeds.

Watering of planted regions is done by sprinkler heads temporarily installed several inches above grade. As the land is presently lacking trees or shrubbery, moisture is applied during the morning hours since the prevailing winds cause high evaporation and erratic placement.

A breakdown of costs of supplies shows that 5,400 pounds of bent and 200 lbs. of Bermuda were used, costing $2,058. Also used were 167 tons of lime at a cost of $1,085.50; 9 tons of phosphate, totaling $769.50; 650 tons of sand, $1,764.75; 200 cu. yds. of manure, $946.00; and 900 lbs. of Kirilium, costing $765.00

A WORKABLE WATER EXTENSION POLICY

WILLIAM T. HAMILTON
Clerk, Water Board,
Hopkinton, Massachusetts

NEW WATER EXTENSIONS have been a headache to the small town of Hopkinton, Massachusetts (*pop.* 4,500), for many years. A special water study committee made numerous inquiries of other towns and held many meetings over a three-year period, acquiring a lot of good information but failing to agree upon a sound water policy or formula. Our Water Board was invited to a meeting of the New England Water Works Association where the subject of financing water extensions was to be openly discussed. Of the 150 members present no one could offer a sound policy. The question always comes up as to who shall pay for what and how much. People in town who have town water do not want to pay for extending service to those who are without water. On the other hand people living in older homes or building new ones, on accepted streets, without town water, want the mains extended to their property. The same articles appear in the town warrant year after year requesting extensions of various distances from 100 feet to a mile or more. Some are feasible; others are not and 90 percent of the time are voted down. Where do the property owner and builder stand? They have no way of knowing when or if the town water supply will ever be extended to their particular property.

Last March all water extension articles were referred to the Water Board by the Appropriation Committee for action. At that time we had no formula to refer to and no answer to give the applicants that would be fair to all. In our way of analysis, the builder of a new home should pay more than a person who had been paying taxes for years on an older one. Many hours were spent on the subject, and after all ideas had been thrashed out we came up with, what we consider, a very fair, sound policy for new water extensions. That is "IT."

1. There must be one house or foundation every 200 feet (average) on the proposed extension.

2. Owners must pay, in advance of installation, their share of total cost: 20 percent minus real estate allowance, viz., house valuation times the number of years the present family has owned the property, with a 20-year time limit; one-half of 1 percent of this total is the real estate allowance.

3. All extensions are figured at $5 per foot.

4. An alternate plan is: Applicants on the extension shall pay for all trenching, backfilling and ledge removal costs; water department to pay for all other expenses.

An example of the application of this policy is as follows: A house which has been owned by the same family for 10 years has an evaluation of $2000. The real estate allowance is ½ of 1 percent of $2000 times 10, or $100. The 200-ft. extension costs $1000. The owner's share of the the cost of the extension becomes $100 (20 percent of $1000, or $200, minus $100). If this were a new house, the owner would have to pay the full 20 percent of the cost or $200.

This policy applies to accepted streets only. Owners or developers must pay the entire cost on new streets.

We have used the main policy and also the "alternate"; both have worked out very satisfactorily to the town as well as the water takers. The various figures on distances, prices, etc., can be altered to fit any town. The basic policy is there; it is up to the heads of your water department to adjust it accordingly.

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Automatic Transmissions Pay Off on Garbage Trucks

An account of repairs, breakdowns, start and stop service and gasoline mileage on garbage hauling units in El Paso, Tex., over the past three years has convinced the Dep't. of Sanitation that the automatic transmission is most desirable. However, three trucks with two-speed rear axles were purchased last year and have given much satisfaction. Recently 9 more GMC trucks with two-speed rear axles and automatic transmission were purchased.

• • •

Quarry and Blacktop Plant Make Money for County

A county quarry has been operated by Montgomery County, N. Y., for the past ten years, and a blacktop plant is operated at the same location. During the winter months, quarry operation is centered on production of a soft limestone for road bases. This material is stockpiled and used during the construction season. During the remainder of the year, the limestone is crushed to the several sizes needed for maintenance work and for supplying the black-top plant.

During the year 1956, the quarry produced 67,430 tons of material at a cost of $58,434.24, or an average of 86.7 cents per ton. This comprised 6,506 tons of stone dust; 3,495 tons of 1-B stone; 21,988 tons of No. 1 and 1-A stone; 4,450 tons of No. 2 stone; 31 tons of No. 3 stone; and 30,960 tons of run-of-crusher shale and stone. Commercial prices of these materials are, per ton, in the order given above: $1.25; $2.00; $2.00; $1.75; $1.75; and $1.00. Based on these prices, the cost of the quarry product, if purchased commercially, would have been $97,900.25. The indicated saving accomplished through the county plant was $39,466.01. Over the ten years the plant has been in operation, the savings are estimated at $271.597.

The blacktop plant has been operated for nine years and estimated savings to the county over this period have aggregated $623,758. In 1956, cost of operation, including allowance for depreciation, was $62,-

139.49. The plant produced 17,238 tons of material, the average cost per ton being $3.60. The cost per ton for blacktop at commercial plants is stated as $7.40 and the net savings by reason of the county-operated plant are $65,139.49 for 1956. The plant produces patch material for use in the spring and fall; and during the construction season it manufactures blacktop for use with the county-owned paver.

Harry R. Mason is County Highway Superintendent and these data are from the 1956 annual report.

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Right-of-Way Fencing on the Kansas Turnpike

The standard width of the Kansas Turnpike right-of-way is 300 ft. in rural sections. Within urban districts, this width varies according to the need. The right-of-way has been enclosed with woven and barbed wire fencing, with wings added to abutments of all bridges and grade separations. In rural areas a stock fence with barbed wire at the top is used. Within urban areas a chain link fence was installed for greater security. It is not possible to walk or drive onto the turnpike except at authorized access points. In this way, its use is restricted solely to paying travelers and operating personnel.

A total of 542 miles of fencing were required as barriers along both right-of-way lines, around structures, and for approaches to all points of access.

All posts are creosoted wood and line posts have a minimum top diameter of 3 in.; corner and end posts are 5 to 6 in. in diam.; and all brace and anchor posts 4 to 5 ins. All were pointed at plants before pressure treatment. At the peak of activity, 22 Danuser post drivers were in use in this work. In line fence erection, 3-in. diameter posts were driven at the rate of 30 per hour with these machines, including time required for moving. Only 30 seconds were required for driving a single post 2 ft. in the ground.

The problem of rock, where encountered, was easily disposed of by drilling 3-in. diameter post holes, or by spudding into rock with air hammers. Contractors were pleased with the speed with which the treated wood posts could be installed by the driving method.

This article is a part of a more comprehensive article on the Kansas Turnpike which appeared in *Wood Preserving News.*

PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Overhead Signs For Better Traffic Control

Adequate signing of any location involves three basic principles: simple and complete message; legibility; and proper placement. At intersections where overhead signs are used an advance destination sign should be placed a distance of 300 to 500 feet from the intersection. Because of wind resistance and load it is impractical to use an overhead sign much larger than 8 feet by 4 feet or 10 feet by 4 feet and the necessity of using large lettering with a heavy stroke requires a condensed message. For multi-lane highways it is desirable to use a separate sign for each lane, particularly if the intersection ahead is channelized. To clear traffic the sign should be at a height of not less than 17 feet above the road. The reflectorization in overhead signing is a much debated subject. Gooseneck and Steber units are the several types of illuminating units that have been used to light signs. There are three structures in general use for mounting the signs: span-wire, mast arms and trusses. The rigid truss structure has been found to be the most satisfactory type to be used in the Virginia State Highway Dept.

"Overhead Signs For Better Traffic Control." By R. W. Wallace, Virginia District Traffic Engineer. PUBLIC WORKS, March.

Highway Litterbugs Cost Millions

Approximately $5,000,000 is spent every year to clean up litter along the highways. South Carolina for example is spending at least a quarter of a million dollars each year to remove litter. In Louisiana clean-up crews carry sacks or hampers, and pick up litter regularly on Fridays and Mondays near cities. Other areas in this state are covered as often as may be necessary to keep the shoulders reasonably clean. Florida has tried deposit stations along their highways for the convenience of motorists who want to deposit litter. Most states have laws that will fine or imprison a person throwing litter along roadways. South Carolina has a fine of $100, or the violator may be imprisoned for 30 days. Through all the discussions with highway departments there runs the idea that only by educating the public can we expect to solve the litter problem. Civic organizations with the cooperation of state highway departments will have to promote educational programs to fight the litterbug. Putting up signs will not help the problem. There are so many signs along the highways now that no one pays more than subconscious attention to them.

"The Highway Litterbug Costs Millions." By Guy Browning Arthur. PUBLIC WORKS, March.

Nocturnal Street Repairs

Phoenix, Arizona, started in 1950 a 6-year, $764,000 street rehabilitation program. The schedule called for resurfacing where the original pavement was sound and capable of providing a good base. Seal-coating was used on streets that were originally constructed of road-mix or where initial construction was not of high standard. The last $200,000 phase of this program was constructed at night. By doing the work at night, daytime traffic interference was eliminated and the streets could be left open to normal night traffic and still be improved one-half at a time. For resurfacing, a hot plant-mix asphaltic concrete was used with an asphalt of 85-100 penetration grade. The mix contained an aggregate of crushed stone graded ⅜-inch down. Specifications called for an application about 1-inch thick running on the average of approximately 1440 tons per mile. Grade B asphalt, applied at the rate of 0.2 gallon psy, made up the sealcoat binder. On this was applied stone chips at the rate of 20 lbs. psy. The streets were heater-planed where needed prior to sealcoating.

"Nocturnal Street Repairs Re-

Rotary Mower Clears Highway Right-of-Way

● MOWING highway right-of-way with an 8-ft. center mount Danco mower on an Oliver Super "77" tractor. This equipment is suitable for all types of roadside mowing, for cutting heavy weeds or for large area mowing, such as at airports.

NO. 212 "GETS THE JOB DONE"

This CAT* No. 212 Motor Grader is owned by the City of Galena Park, Texas. It is shown here cutting out old street surface to a depth of 8 inches. Then 8 inches of stabilized shell is put in and the street refinished with 1½ inches of blacktop.

With 10 days off because of rain, the machine completed the job in a month. D. J. Campbell, Street Superintendent for Galena Park, says: "We used to have a grader of another make, and the expense of upkeep just ate us up. With Caterpillar-built machines we never worry about upkeep and the fuel is insignificant. They're rugged and they get the job done."

When you're choosing a motor grader the question isn't "How big is it?" but "How much work will it do in a year?" The No. 212 is designed to fill all the needs of many municipalities. While it is the smallest and lowest-priced grader in the Caterpillar line, it's built with all the rugged stamina of the bigger machines. The dependable 50 HP Cat Diesel Engine is balanced with weight, speed and traction to deliver a solid day's work, day after day, with practically no down time.

The No. 212 costs less to buy, less for fuel and repairs. Operators like its positive-acting power controls, easy, accurate steering, quick blade positioning and complete job visibility from the seat. New *tubeless tires* eliminate tube and flap trouble and greatly reduce tire down time, yet cost no more.

Let your Caterpillar Dealer show you how a Cat No. 212 can save your taxpayers' money. His reliable parts and service facilities stand behind your investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

ceive Public Approval." By Albert R. Pierce, Administrative Assistant to the Public Works Director of Phoenix, Ariz. *American City*, February.

Jackets of Creosoted Wood Protect Concrete Piles

The deterioration of precast concreted piles in the tide waters in and adjacent to New York City has been prevented for periods ranging up to 33 years by means of the placement of pressure creosoted wood jackets in the tide zone. In contrast to this record, in a structure comprising about 1,000 unprotected piles in the same tide waters, over 970 piles required extensive and costly repairs. The lumber for the jackets was pressure-creosoted with coal tar creosote or creosote-coal tar solutions.

"Jackets of Creosoted Wood Protect Concrete Piles." By Ralph H. Mann, District American Wood Preservers Institute. *Engineering News-Record, February*, 14th.

Why Build Soil Cement Roads?

As a result of glaciers which covered Michigan in prehistoric times, all county roads were originally improved with gravel surfaces. Today the gravel deposits have been depleted and it appears if maintenance gravel is to be used, it will have to be shipped in. For this reason and the fact that the income of the Road Commission is not sufficient to build high-type surfaces such as concrete pavement, or asphalt surfaces on bases and subbases that can be expected to carry today's heavy traffic without premature failures, soil cement roads are the answer. In 1951 the first soil cement bases were built 20 feet wide and 6 inches thick compacted, using 8 percent Portland cement by volume. Methods and equipment seemed somewhat crude and daily production was small when compared to present day accomplishments These first roads cost $1.00 psy to build. In 1956, 29 miles of soil cement roads involving 343,320 square yards were built. The average cost was $0.97 per yard or $11,523.60 per mile. If preparing the grade is left out, the cost per square yard is $0.895 and the cost per mile $10,623.00. A portable 500-barrel cement bin is used to store the bulk cement. A Hercules cement spreader is used to spread the cement, and dump trucks, carrying 30 barrels each, deliver it to the spreader. A contract was let

WISCONSIN cuts costs with HIGH DENSITY OVERLAID* plywood signs

State's 150,000 signs are maintained by 18 two-man crews; central sign shop is in Madison.

The Traffic Services Section of the State Highway Commission of Wisconsin has experimented with every type of sign material on the market. On the basis of tests and field experience, it is now using considerable amounts of high density overlaid plywood for reflectorized highway signs. The commission cites these three reasons why:

1. Lower cost—Department figures on completed reflectorized signs show high density overlaid plywood enjoys a marked advantage over metal. A 30″ overlaid plywood STOP sign for example, costs $1.05 less than 0.081″ aluminum.

2. Durability, appearance, vandal resistance—The overlay prevents checking or grain raise, extends useful life of sign. The unpainted sign back surface has a pleasing appearance, and the material seems less subject to vandalism than metal, especially by shooting.

3. Adaptability—Panels can be carried in stock in full sheets and cut to size as needed with inexpensive shop tools. Larger size plywood signs require fewer posts and framing members than comparable sheet metal signs.

OVERLAID FIR PLYWOOD* GIVES YOU THESE ADVANTAGES:

- Combines strength, rigidity and workability of plywood with smooth, durable fused resin-fiber surfaces.
- Great resistance to severe weathering . . . accidents . . . gunshot, bending, other acts of vandalism. No progressive deterioration after damage. Cannot rust or corrode.
- Perfect for long-lasting paint or silk screen finishes. Reflective sheeting may be applied direct to high density overlay, eliminating prime coat.

*OVERLAID PLYWOOD is top-quality DFPA quality-tested Exterior fir plywood (EXT-DFPA®). Two types: (1) High density overlay is hard, glossy; (2) Medium density is opaque, with texture like drawing paper.

DFPA TESTED QUALITY

OVERLAID* Fir Plywood

MAIL COUPON FOR DETAILED INFORMATION

DOUGLAS FIR PLYWOOD ASSOCIATION
Tacoma 2, Washington, Dept. 140 (Good USA only)
Please send complete application-specification data for overlaid plywood for traffic signs.

Name_____

Firm or Dept._____

Address_____

City_____ Zone_____ State_____

for the mixing to be done with a P & H one pass stabilizer which mixed a 10-foot, 3-inch strip at a single pass and added the necessary water. Rolling and finishing were handled by Road Commission forces. A traveling laboratory was kept on the job at all times for checking the moisture in the mix as well as the moisture density and dry density. The laboratory consisted of a station wagon and the following: One moisture density mold; one moisture density rammer; one Pycnometer; one scale, 36# capacity; one 2-burner Coleman stove; one 12-in. steel rule; one large spoon; one mason hammer; one 12-in. butcher knife; 8-in. and 10-in. frying pans; two 10-qt. pails; one salt shaker; one small wood chisel; one trench shovel; one 1-gal. gas can; one #4 standard sieve; one 2-in. paint brush; one notebook; one 50-ft. steel tape. In 1957, two one-pass mixing machines will be used which will enable the finishing equipment to work the whole width of road at one time. This will increase the production rate over 1956 which ran as high as 16,084 square yards in a regular 8½-hour work day.

"Why Build Soil Cement Roads?", by J. T. Sharpensteen, Genesee County Highway Engineer, Flint, Michigan. PUBLIC WORKS, March.

Kansas City Opens Underground Garage

Kansas City's new self-parking 1200-car garage serves the Municipal Auditorium, hotels and business district, while removing an old downtown eyesore. The garage rests on solid rock and has reinforced concrete floor slabs 10½ inches thick and a roof slab 14 inches thick. The roof has been covered with 18 to 36 inches of earth and planted as a formal park. Fans, located in rooms at each corner of the garage, can exhaust 1,500,000 cu. ft. of air per minute. Carbon monoxide detectors are located throughout the building. Parking stalls are over 8 ft. wide and by "warping" each floor steep ramps are eliminated. The columns on each level are painted a different distinctive color for the convenience of the patrons. Also, rows and bays are designated by numbers and letters virtually to eliminate the possibility of forgetting where your car was parked. The construction of the structure was financed by $4,100,000 in revenue bonds.

"Kansas City Opens Underground Garage". By Graham W. Watt, Administrative Assistant to City Manager, Kansas City, Mo. *Street Engineering*, January.

Ice-Breaking Machine Speeds Winter Work

This ice-breaker developed by mechanics at a Minnesota Department of Highways district highway shop has been used for several years for ice control. The heart of the machine is a bilateral spiral blade mounted on a rotating shaft so that it cuts the ice in a "V" pattern as it moves down the highway. In order to deliver the pressure necessary to shatter the ice, a hydraulic system is utilized that permits the application of as much as 550 psi of downward pressure. The crusher is 48 inches wide and is mounted on a 5 to 10-ton truck, which can be operated at a speed of from 7 to 9 mph.

"Ice-Breaking Machine Speeds Winter Work." *Better Roads*, February.

Highway Manual Helps Townships

In order to perform a better service for the townsmen and also to reduce the workload in the county

One application controls dust all season!
GULF SANI-SOIL-SET

Gulf Sani-Soil-Set is the effective, economical answer to your dust annoyance problems. Here's why . . .

TAKES EFFECT INSTANTLY. Sani-Soil-Set coats and permeates surface soil evenly, anchoring the dust immediately. No long waiting periods are necessary before the ground is ready for use.

ONE APPLICATION LASTS ALL SEASON. Rain does not wash Sani-Soil-Set away—sunshine does not affect it. One application is usually sufficient to keep dust down for an entire season, so costs are minimized.

EASY TO APPLY. Sani-Soil-Set is a free-flowing liquid, not a tar. It has no offensive odor. It can be hand-sprinkled or applied by sprinkling truck and spreads quickly.

MAKES YOU A BETTER NEIGHBOR. Sani-Soil-Set prevents dust from blowing into nearby buildings and homes. Your neighbors will appreciate Sani-Soil-Set's effectiveness.

Gulf Sani-Soil-Set has proved an efficient dust allayer for playgrounds, athletic fields, parking lots, race tracks and other bare-earth areas. You can have a free demonstration simply by contacting your nearest Gulf office. For more information, mail coupon for descriptive pamphlet.

GULF

GULF OIL CORPORATION PW
1822 Gulf Building, Pittsburgh 30, Pa.
Please send me a copy of your free pamphlet, "Gulf Sani-Soil-Set —the modern, proven agent for controlling dust."

Name_____

Title_____

Address_____

City_____ Zone____ State_____

highway department, a guide book or manual was devised for town superintendents of highways in Oneida County, New York. The first subject in the manual is a road map of the town and a map of the county, with a 1-square-mile grid system and numbered squares for locating emergency disasters. Other subjects included are the town highway system and county aid under the New York highway law, the 10-year town highway-improvement program with state aid, engineering data, equipment purchasing and miscellaneous records.

"Highway Manual Helps Townships Do a Better Highway Job." By Gordon Baird, County Superintendent of Highways, Oneida County, N. Y. *Better Roads*, February.

Other Articles

"Erosion Control as Tool in *Maintenance*." By the late M. W. Fisher, Engineer of Maintenance, State Highway Commission of Wisconsin. Public Works, March.

"Atlanta Has a Top-Level *Traffic Control* System." Public Works, March.

"Manchester, England *Airport Development* Costs Mounting" because new American jet airliners bring demand for 10,000-ft. runway. The Surveyor, Jan. 12.

"Use of *Fly Ash in Concrete*." By Albert G. Timms and William E. Grieb, Highway Research Engineers. Public Roads, February.

"Application of *Soil Surveys* to Highway Design and Construction." By Dr. G. G. Meyerhof, Head, Dept. of Civil Engineering, Nova Scotia Technical College, Halifax, N. S. Road and Engineering Construction, January.

"South's Largest *Ramp-Type Parking Garage* Completed. This facility in Houston, Texas, cost approximately $3,000,000 and has parking space for 1500 cars. By Robert O. Grimes, Associate and Senior Project Engineer, H. E. Bovay, Jr., Consulting Engineers, Houston, Tex. Civil Engineering, Feb.

"Innovations Stepped Up This *Concrete Paving Job*." High-speed truck hoists, combination finisher and bullfloat machine, sectional aggregate batching tunnel, subgrader with quick-change crown were among the labor saving devices. Roads and Streets, February.

"*Four-Year Engineering Curricula* Not Sufficient." By Samuel B. Folk, Professor of Engineering Mechanics, The Ohio State University. Civil Engineering, February, 1957.

"What Size *Unit to Haul Materials?*" A cost comparison shows the savings possible through making the right choice of equipment. By R. L. Peurifoy, Professor of Construction Engineering, Texas A & M College. Roads and Streets, February.

Highway Signs Give Safety Advice in Rhyme

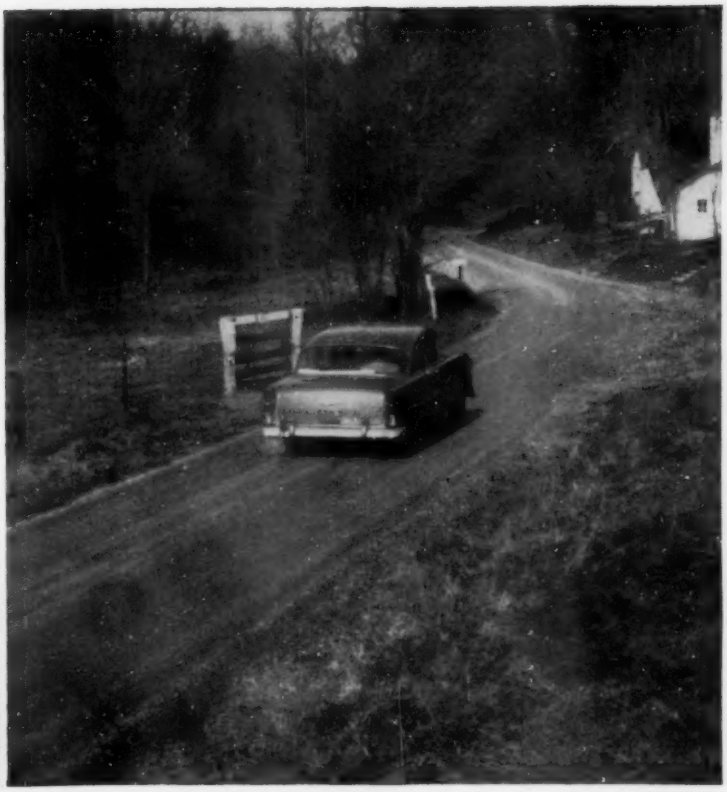
TRAVELERS ON the 196-mile stretch of US 301 that crosses North Carolina get safety reminders every mile or so of the way in the form of pert little verses lettered on attractive blue and white reflectorized signs.

A project of the Governor's Traffic Safety Council, the signs carry a variety of such eye catching messages as "A mile a minute—there's no future in it"; "Careful with a carfull"; "If you're late, let 'em wait". Altogether some 50 different verses, originated by two North Carolina highway commissioners, appear along heavily traveled 301, the state's principal north-south tourist thoroughfare. Many of them are rhymed ("The minute you spare will get you there"), and all are keyed to a general traffic safety theme. Specific road conditions ahead are frequently marked by reminders like "Don't be impatient, it's a short hill", and "Heavy foot, light head, bad curve, stone dead."

Original cost of the signs, some 180 of them, totaled about $3000, or $1.60 per square foot including reflectorizing material. The legends

Shape to restore proper inverted V type crown as early as possible for best drainage and elimination of dangerous potholes.

Surface-treat with Columbia Calcium Chloride at a rate of 1 pound per square yard of surface, after sprinkling road with water.



Proper spring maintenance, supported by summer sweetening applications of Columbia Calcium Chloride, keeps roads firm, prevents dusting or raveling.

Now's the time to check aggregate, reshape roads, and get ready to spread Columbia Calcium Chloride

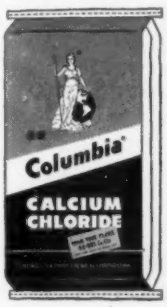
Good spring and summer roads are made right now! Smooth, compact, durable surfaces don't just *happen* . . . they're the happy result of your early maintenance, carried out this tested three-step way:

1. Check for proper balance of aggregate and binder in the roadbed, adding where necessary. **2.** Reshape to proper crown while sufficient moisture is still in the ground. **3.** Treat with Columbia Calcium Chloride.

Columbia Calcium Chloride aids so greatly in consolidating existing and added materials that only three or four bladings per year are usually necessary. Annual gravel loss is cut up to 75%, too. And what a help you'll find it in stabilizing shoulders. Lower maintenance costs, yet safer and more comfortable driving . . . no wonder Columbia Calcium Chloride is the preferred road treating chemical. You'll use it throughout the summer for effective dust control, as well.

We'll be happy to send you the latest information on new economies in road treatment. Contact your closest supplier or write directly to the nearest Columbia-Southern district office or to our Pittsburgh address.

New High Test Flake (95-98% $CaCl_2$) is now available as a companion product to Regular Flake (77-80% $CaCl_2$). Each 80-lb. bag of High Test does the job of a 100-lb. bag of Regular.



COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland • Boston New York • St. Louis • Minneapolis • New Orleans • Dallas • Houston Pittsburgh • Philadelphia • San Francisco

IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

are white and are inscribed on a dark blue field.

No "before and after" accident analysis to test the signs' persuasive powers has been set up, however, officials say that the project will be continued on an experimental basis.

Reaction to the signs has been mixed. "Ingenious, corny, terrible, good idea, traffic hazard", and the like, have been among the comments, personal and public. One criticism of the safety odes is that they are difficult to read "Apparently designed for slow drivers who are faster readers", editorialized one newspaper. Many travelers have been inspired to submit offerings of their own, along with hundreds of letters commending the state for its nationally acclaimed road safety program.

The original authors of the messages say "We've taken a lot of kidding about the signs, but obviously motorists read them, and that's the important thing." But humor aside, the signs are part of an intensive safety campaign that is no laughing matter in North Carolina. The program, now in its fourth year, has been largely responsible for a downward trend in road fatalities for two consecutive years—in 1955, and again last year.

And not only do the signs warn motorists that safe driving is best, but a tandem arrangement of them greets visitors as they cross the Virginia line into North Carolina.

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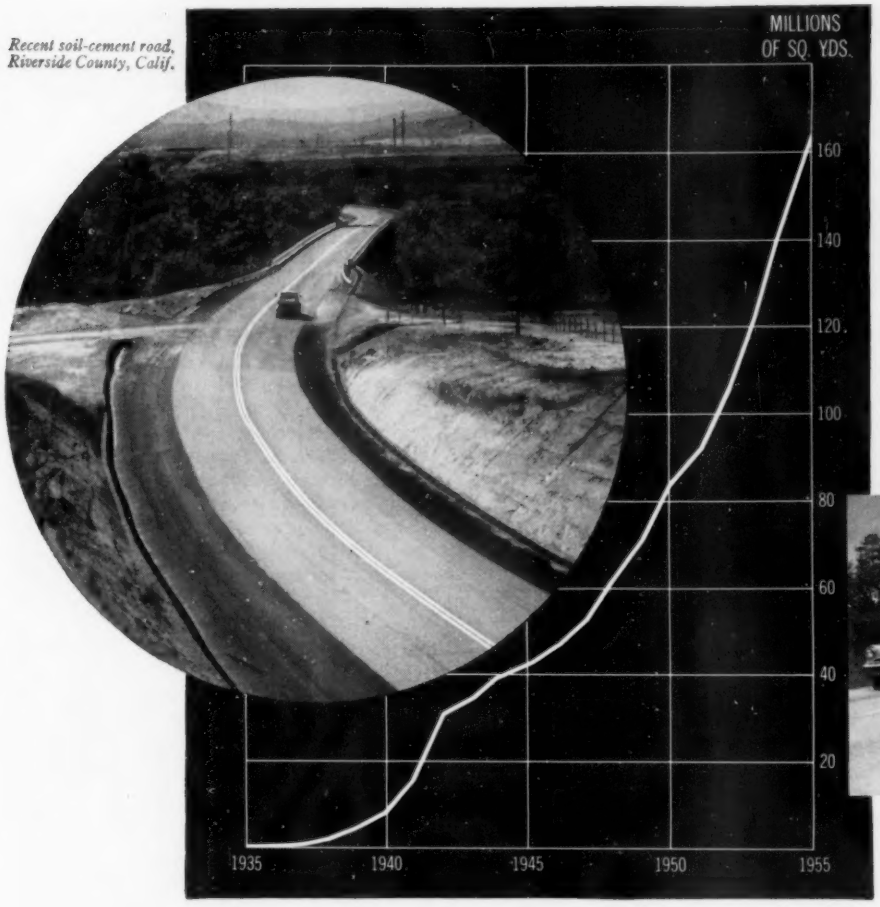
Two Way Radio For a County Highway Department

A two-way radio system is now being installed for Montgomery County, New York. One-half of the cost of the system will be paid for by the Federal Civil Defense Administration. Installation is by Motorola, from whom the system is leased at a total cost of $2850 annually, the county paying half of this. The system consists of six mobile units and two base stations. The mobile units are installed in pickup trucks and cars in the summer and in snow plows in the winter. One base station is at the highway office in Fonda and the other at the county-owned quarry and blacktop plant. The main transmitter is located at a high point in the county. A prefabricated metal building and a 50-ft. wooden antenna pole were constructed by county forces. A Kohler gasoline engine and generator were installed to provide power in case of failure of the main source.

Recent soil-cement road, Riverside County, Calif.



America's first scientifically-controlled soil-cement road. Rt. 41, near Johnsonville, S. C. Built in 1935, this photo was taken in 1955.

Growing Popularity of *SOIL-CEMENT* is based on 20-year success story

The graph shows the sensational growth of soil-cement pavement* since 1935, when scientifically-controlled soil-cement was first introduced. Note that by the end of 1955, 161,155,325 sq. yd. had been placed in the United States, Alaska and Canada. This 20-year success story is due to these important advantages:

SOIL-CEMENT IS ECONOMICAL. About 85% of the required material is usually available on or near the site. This saves both material and transportation costs.

SOIL-CEMENT CONSTRUCTION IS FAST. Crews quickly learn the simple construction techniques and have built as much as a mile and more of pavement in a single day.

SOIL-CEMENT IS DURABLE. Soil-cement has proved its durability in all climates. Nearly all the soil-cement pavement ever built is still in service—usually carrying heavier traffic than it was designed for.

SOIL-CEMENT MAINTENANCE COSTS ARE LOW. Maintenance records demonstrate the extremely low cost of keeping soil-cement pavement in good repair.

For more information about economical, durable soil-cement pavement write today for free, illustrated literature. Distributed only in the U.S. and Canada.

*Soil-cement pavement consists of soil-cement base and bituminous surface.

PORTLAND CEMENT ASSOCIATION Dept. A4-89, 33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Taste and Odor Removal

The sources of water for Philadelphia are the Schuylkill and Delaware Rivers, which receive domestic sewage and industrial wastes. Because of the variety of pollution sources, the odors and tastes were varied, woody, vegetable, algae, phenolic, chorophenolic, iodoform, and medicinal. Activated carbon, chlorine, chlorine dioxide and ozone have been used successfully at various points of application for taste and odor reduction at the four treatment plants since 1947. Removal of organics from the Schuylkill River bed and elimination of their waste sources has helped reduce intensity of organic tastes. Continuous sludge removal at a new pretreatment plant at Queen Lane has assisted. Surface wash for the filters at the Belmont Plant has helped. A plant improvement program underway will, when completed, provide free residual chlorination in large basins before other chemical treatment, activated carbon application to handle material that cannot be oxidized, chlorine dioxide treatment for standby use on all post-treatment points and for pretreatment at Torresdale, continuous sludge removal and mechanical mixing and flocculation, surface wash with semi-automatic wash control for the filters, and around-the-clock laboratory control at each plant.

"Taste and Odor Control at Philadelphia." By Elwood L. Bean, Chief Water Treatment Section, Philadelphia. *Jour. A. W. W. Assn.*, February.

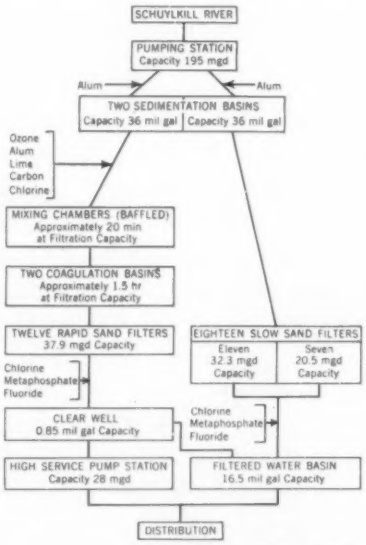
Nerve Gases In Water

Few chemical agents in water are dangerous. Even Lewisite hydrolyzes rapidly and as much as 20 ppm can be tolerated. The nitrogen mustards are easily detected and removed or neutralized. More important are the nerve gases Tabun and Sarin. The level of tolerance of Sarin in water is set at 0.5 ppm. Tabun is about one-fourth as toxic as Sarin. At least two feasible methods of destroying them are available, both based on an acceleration of the normal hydrolysis rate and involving chlorination or alkalinization. These methods are described by the author.

"Nerve Gas and Public Water Supplies." By Joseph Epstein, of Chemical Warfare Laboratories. PUBLIC WORKS, March.

Vertical Filter Plant at Lynchburg

Pedlar River, and Reservoir sources of Lynchburg's water supply are in the Blue Ridge Mountains 21 miles from the city and at an elevation of 1015.5 ft., with the watershed chiefly in the George Washington National Forest. The original filtration plant involved a pressure filter system to conserve head required for Lynchburg's seven hills. Demands of industry and out-of-city customers prompted an expansion program—commenced in 1952 and to include a new filtration plant to be completed in 1957.



Courtesy Journal of AWWA

● **FLOW diagram and treatment plan, taste and odor control at Philadelphia.**

The new plant building is 7 stories high, with filter units and operating gallery on the top floor. The coagulation basin is at the same level. Chemical storage will occupy the fifth floor. Feeders, wash water and booster pumps, and the laboratory are located on the fourth. The third floor provides space for the meter repair shop and storage for distribution system supplies, and the Water Dept. offices, chlorine storage, boiler room, and transformer vault are on the first. The distribution system is divided into four pressure levels, with three storage reservoirs varying in capacity from 0.8 to 2 MG. Pressures vary from 25 to 138 psi, because of the topography. The water is very soft, and to overcome red water troubles, Calgon has been used effectively.

"Lynchburg Filters Perched Atop New Seven-Story Treatment Plant." By R. D. Wright, Director, Water Dept. *Water Works Engineering*, February.

Evaluation of Diatomite Filter Experience

The Iowa Engineering Experiment Station conducted a preliminary evaluation of diatomite filters in municipal installations by conducting a questionnaire survey of health department experience and by evaluating existing municipal installations. Twenty state health departments at the time of the survey, did not approve the installation of the filters for municipal use, 14 had no fixed policy, 6 approved, and 9 states and Alaska approved them with reservations. Sixteen of the 29 existing installations were visited to study the conditions under which they were operating. The experience of seven plants in Michigan and 3 in New York indicates that the filters can be used successfully and economically on lake waters containing up to 80 ppm turbidity. It was also indicated that the effectiveness and economy of all plants could be improved by the better application of the principles of body feed. Controlled field tests should be

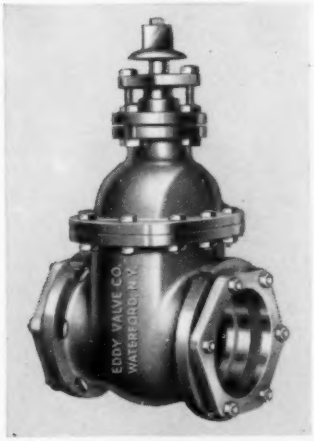
OUT THEY GO!

and IN go EDDY HYDRANTS

Many of the 650 fire hydrants in Maywood, Illinois (pop. 30,000), have been in service 40 years or longer. Some were no longer being manufactured, and repair parts were unavailable. In a decision to modernize its hydrants, Maywood decided to standardize on Eddy hydrants in 1954—to simplify servicing, cut maintenance costs, reduce parts inventory, and assure service for the future.

Eddy hydrants had proved highly satisfactory in Maywood's 50-mile system, and repair parts have always been available. Under the aggressive direction of public works director Bazel E. Crowe, above left, the replacement program, has proceeded at a fast, economical rate, with more than 170 hydrants replaced in 1956 alone.

it's the safest, most economical course!



EDDY
AWWA (UNDERGROUND) VALVES

Everything in AWWA valves for underground use in your waterworks system is quickly available from Eddy—gate valves; cutting-in valves and sleeves; tapping valves and sleeves. And, remember, Eddy's more than 100 years' dependable operation is your assurance of service far into the future.

Maywood feels that it cannot risk hydrant failure, nor afford the sky-high cost of handmaking individual repair parts for obsolete, "orphan" fire hydrants. Can you?

Based on the experience of this and other alert communities, your city or village might do well to take stock of its hydrant situation. If so, an EDDY man will be very glad to give facts and figures you will find most helpful in making a wise decision. Won't you invite him to see you . . . soon?

AWWA EDDY BRONZE-MOUNTED HYDRANTS

EDDY Bronze-Mounted HYDRANTS open smoothly with the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held in place below hydrant valve means that there is no water loss due to a bent stem.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
WATERFORD NEW YORK

made at existing plants for further evaluation, and a detailed review dealing with items to be considered i the review of plans for diatomite filters should be prepared and distributed to improve the design of future municipal plants.

"Diatomite Filters for Municipal Installations." By E. Robert Baumann, Iowa State College. *Jour., A. W. W. Ass'n.*, February.

Ground Storage Reservoir Eases Supply Shortage

To combat a developing water shortage created by increasing drafts on its ground water supply, Riverside, Illinois, is constructing a 675,000-gallon underground storage reservoir which is filled from a 16-in. main tapping Lake Michigan. Restrictions are placed on the Lake Michigan supply in that it may not be used between 5 pm and 9 pm. The reservoir construction is expected to overcome the hazard of being short during a peak period. To remedy another phase of the water shortage problem, insufficient pipe carrying capacity in the distribution system for fire flows, some four miles of 10- and 12-in. will be constructed in the next few years. Riverside's two wells have lost a total of 450 gpm or more than 20 percent of their original yield.

"How One Community Is Beating the Water Shortage." By Phil Hirsch. PUBLIC WORKS, March.

Application of Membrane Filter Technique

In attempting to evaluate the sanitary quality of lake water, used as a source of water supply and distributed for public use with chlorination only, an MF Field Monitoring Kit was used for lake sampling. A 14-ft. outboard motor boat carried all of the equipment needed for sampling, filtration and inoculation of the prepared samples with culture media. Ninety samples were taken in three days at points near pollution sources. One man was able to take and prepare an average of 10 samples per hour, with an extra man to operate the boat. In the use of the MF Kit, a sample is drawn through a plastic "monitor" containing the membrane filter by means of a syringe. The filter is then inoculated with endo culture medium and stored in a field incubator. Coliform counts varied from 0 to 196 per ml, which indicated corrective action was needed.

"Rapid Field Analyses Pinpoint Coliform Contamination in Reservoir." By Rolf Eliassen, Massachusetts Institute of Technology. *Water Works Engineering*, February.

Justification for Higher Rates

Water has been sold by municipalities at too low a charge for several decades. This has been possible through the use of tax funds for capital outlays, inadequate accounting for depreciation in rate structures, inadequate maintenance and exhaustion of growth capacity in main parts of the system. The changes in living conditions have resulted in necessary expansion of facilities at a higher unit cost than was expended originally. The end effect has made water rate increases unusually high to compensate for the original too low rates. Some cities faced with expansion on a metropolitan area basis have adopted innovations such as demand charges and doubled out-of-city-limit rates. The solution of the rate problem in a given area should include evaluation of costs of fire protection and the assumption of fire protection costs by the public, assignment of

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PLYMOUTH

FILE REFERENCE

FACT SHEET

GRAVER®

Elevated Water Tank for the City of Plymouth, Indiana

Ralph Lentz, Water Works Superintendent
Clyde E. Williams & Associates, Inc.,
Consulting Engineers, South Bend and Indianapolis, Ind. and Lansing Mich.
Lloyd Taylor, Project Engineer
Graver Tank & Mfg. Co., Inc.,
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 400,000 gallons
Height of Overflow: 130 feet
Low Water Level: 100 feet
Diameter of Tank: 50 feet
Built to AWWA Specifications, except that ¼" plate was used on the roof instead of ⅜" minimum
Painted and Sterilized

THE PROBLEM

A water supply system designed to serve a rural county seat of 3,838 people was woefully inadequate for today's population of 6,704 in this thriving trading center. One industry alone consumed one-third of the water. And the situation was further complicated by a disasterous flood in 1954 which polluted the city's wells located near the Yellow River. Steps had to be taken without delay to meet the problem.

THE SOLUTION

Anticipating probable population and commercial requirements by 1980, plans were developed for new wells, larger mains, and adequate pumping and storage capacity. Standards of the National Board of Fire Underwriters indicated a fire pumping formula of 150% of the flow required for normal domestic use, plus 10 hours of fire flow. The desirable storage capacity was set at 500,000 gallons, 100,000 gallons in an existing tank and 400,000 gallons in a new tank.

Graver was selected to design, fabricate, erect, paint and sterilize the new 400,000 gallon elevated water tank.

The close teamwork of the city's water works superintendent, the consulting engineers and the Graver organization speeded the elevated water tank erection so that the new water system could be put into operation in 1956.

If you have a water storage or pressure problem, it would be well to talk it over with a qualified consulting engineering firm and Graver, whose 100 years of experience in tank fabrication and erection can contribute measurably to your plans.

GRAVER TANK & MFG. CO., INC.
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New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Detroit • Chicago • Tulsa • Sand Springs, Oklahoma • Houston • Los Angeles
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Water Treatment Specialists

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Water and Industrial Waste Treatment Equipment to meet all requirements

High Rate Softeners and Clarifiers
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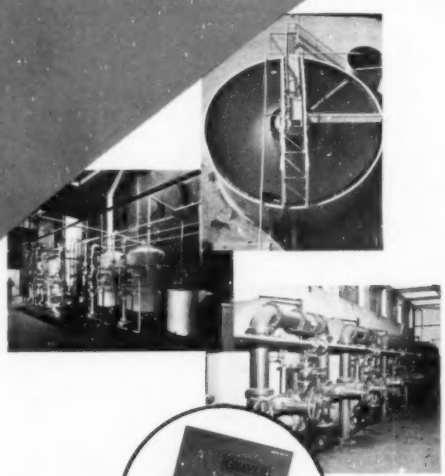

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AND SPECIFIC BULLETINS

Dept: WS

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GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

responsibility for peak consumption according to customer groups, allocation of commodity costs to the respective groups according to the commodity sold, and make special charges for nonconserved air conditioning.

"Determination of Municipal Water Rates." By Albert P. Learned, Black and Veatch, Kansas City. *Jour., A. W. W. Ass'n.*, February.

Expansion of Reading Water System

As a result of industrial and suburban expansion, Reading, Pa., is spending $4 million on enlargement of its water system. Present peak demands of 135,000 persons is 22 mgd; the new facilities will accommodate 30 mgd. The construction program includes adding six new filters, each with a capacity of 3.3 mgd, equipped with Anthrafilt. To overcome problems created by frequent breaks in treated water supply lines, an additional 30-in. transmission line will be constructed. At three Schuylkill River crossings, the line will be encased in 6 inches of concrete. Two new reservoirs, 13 mg each, are being built of prestressed concrete.

"Industrial and Suburban Growth Prompts Expansion of Water System." Charles H. Kessler. PUBLIC WORKS, March.

Other Articles

"The California Water Plan and Its Administration." A panel discussion including the following sub-topics: "California Is Listening," by S. B. Morris; "Water Problem for the Legislature," by Harold J. Powers; "The Program of the Department of Water Resources," H. O. Banks; "Program of the Water Rights Board," by Henry Holsinger; "Where Should Local Water Authorities Take the Initiative?" by John W. McFarland; "Local Authorities' Part," by William Berry; "Financing the Plan," by Bruce F. Allen; "Flood Control Problems," by W. F. Cassidy; "Federal Service and the Plan," by C. H. Spencer; "Legal Questions to Be Answered," by Wallace Howland; and "Summary," by S. B. Morris. *Jour., A.W.W. Ass'n*, February.

"Rebuilding a Small Public Water System," in Burnsville, W. Va. By J. Wallace Grant. *Jour. A.W.W. Ass'n*, February.

"Preparing for a Rate Increase." A panel discussion, including the following sub-topics: "Utility Viewpoint," by C. C. McDonald, Charleston, W. Va.; "PSC Viewpoint," by H. W. Hanna, Jr., Charleston, W. Va.; and "Legal Aspects," by Ben K. Baer, Charleston, W. Va. *Jour., A.W.W. Ass'n.*, February.

"Air Conditioning Expansion and Regulation." By T. B. Robinson, Black

and Veatch. *Jour., A.W.W. Ass'n.*, February.

"Inspecting and Testing Stationary Chlorine Storage Facilities." By J. L. Burnett and C. P. Roddy, Tampa, Fla. *Jour., A.W.W. Ass'n.*, February.

"Engineered Expansion Program Benefits Atlanta's Annexed Areas." By Paul H. Weir, Atlanta, Ga. *Water and Sewage Works*, February.

"Operation and Maintenance of Water Distribution Systems." By Wallace T. Miller, Research Engineer, Cast Iron Pipe Research Association. *Water and Sewage Works*, February.

"Why Water Meters are Advantageous." By H. G. Greer, Neptune Meters. *Water and Sewage Works*, February.

AWWA Establishes Wendell R. Ladue Safety Awards

The American Water Works Association has established a series of safety awards, which it has named in honor of Wendell R. LaDue, superintendent and chief engineer of the Akron, Ohio, Bureau of Water Supply. The awards are intended to encourage safety practices in public water utilities throughout the country and to carry forward the program that was initiated with the recent development of the AWWA Safety Practices Manual.

The new award plan is divided into two parts, one based on activities within the Association's regional sections, and the other giving Association-wide recognition for safety achievements. Because member utilities vary in size from those employing only one staff member to those with 3,500 employees, the section safety award plan consists of three awards: the Award of Honor, the Award of Merit, and the Award of Progress. Utilities will be eligible for the Award of Progress by demonstrating a prescribed percentage reduction over the injury frequency rate for the previous year. To make the competition fair, percentage reductions vary with the size of the utility. Size groupings are: fewer than 10 employees; 10 to 100 employees; and more than 100 employees.

The Association awards for safety will be made only to sections awardees, and only three such awards will be presented each year. The award committee has not yet determined the exact criteria by which the awardees will be determined, but the member utilities will again be classified according to size, as indicated above. One award will be presented in each class annually.

Wendell R. LaDue, in whose honor the awards were named, has been instrumental in making the water works field safety conscious through his leadership in the development of the Association's present safety program. A member of the Association since 1934, Mr. LaDue served as the Association's president in 1947 and is now chairman of the Committee on Water Works Administration and a member of the Board of Directors. He has been active in the development of a successful and widely recognized municipal safety program in Akron and has received several awards from the Association for his outstanding work in the field of public water supply. It was because of these many achievements that the Association named the new awards in his honor.

• • •

Injury Rates for the Construction Industry

The average injury rate for the construction industry increased from 32.1 injuries per million man-hours in 1954 to 34.5 in 1955. Disability due to work injuries in construction averaged 89 days per case; with a total of 2,759 days of disability for each million man-hours worked. These data are from the U. S. Dept. of Labor.

● **ELEVEN municapally owned compactor trucks such as this one collect an average of 2½ loads per day, six days a week, from 60,000 to Tucson's 100,000 population.**

Sanitary Landfill Costs 68¢ per ton for DISPOSAL

CHANGING its refuse disposal system nearly five years ago to sanitary landfill, Tucson, Ariz., has since kept complete and continuous records on cost and efficiency. Over this period, by maintaining statistical records of every load of waste and every cost, Tucson has been able to utilize its tractors and trucks to best advantage, making its landfill one of the most outstanding in the West.

Tucson is a pioneer in weighing loads and maintaining records. On the landfill site is a truck scale where each loaded truck is weighed. The primary purpose of weighing is to balance routes, but it also serves to keep check of personnel efficiency. In testing demonstrator trucks, it has, on occasion, proven to be advantageous.

The city owns 11 Gar Wood and Leach compactor trucks and 12 open trash trucks and trailers for tree limbs and large refuse. These collect from approximately 60,000 of the 100,000 people living within the city limits, plus the commercial establishments. By contract, Arizona Transport Co. keeps an average of 4 trucks busy collecting from the other 40,000. Each compactor truck averages 2½ loads a day, 6 days a week; open trucks, 2 loads; and Arizona Transport trucks, 2 to 3 loads a day. There is also private dumping.

As each truck enters the landfill property it goes directly to the scale. The scale keeper records what truck it is, what time it dumps, the weight of the load and the time it leaves. Different sheets are used for the various types of loads and trucks —garbage, trash, street sweepings, Arizona Transport and private trucks. These sheets are sent to the Department of Sanitation office where the total weight per month for the various types of refuse is computed. A budget statement from the City Treasurer enables the Department to figure the cost per ton of garbage, trash, private dumping, etc.

Tucson's average cost for its landfill method of refuse disposal has been holding at about 68¢ per ton. The landfill, at present, occupies 50 acres of eroded wasteland near the base of "A" Mountain. The city had been using the trench method, uses it now during wet periods, and will return to it in the future. But at present, the refuse is going into a 20-ft. deep clay pit, adjoining the regular landfill site. The pit goes to the water level of the Santa Cruz River that borders it. When filled, it will serve for the control of flash floods.

As the trucks come into the fill and dump their 3,000-lb. loads, an International TD18 tractor heaps it on a 45 percent slope and compacts it. From time to time water is sprayed on the refuse to aid compaction. When operations first started in the pit, 2 ft. of garbage and trash were spread over the floor to absorb water and to build a sound footing. Since then, the daily accumulation of refuse has been enclosed in cells, sealed by 8 in. of cover.

Cover material is excavated by a Caterpillar D8 tractor with a No. 70 scraper. When a backlog of cover has been dug, this tractor is occasionally loaned to the Park, Sewer or Water Department for other municipal work.

When the trench method is employed, the D8 and No. 70 cut a trench 15 ft. deep, 15 ft. wide and 100 yds. long. The refuse cells are built up in the trench, then for 15 ft. above the surface, the top 4 ft. of which is cover. When completed, Sudan grass will be planted to check washing and erosion.

● **TRENCH is cut by a Caterpillar D8 Tractor with No. 70 Scraper. Average trench size is 15 x 15 x 300 ft.**

Working on the landfill, besides the foreman, Thomas Price, who is a night school student at the University of Arizona College of Engineering, are two full time tractor operators and a scale keeper. Another man is used part time as tractor operator, but spends the major portion of his time maintaining the equipment.

Leading to the fill is a system of gravel all-weather haul roads. These are sprinkled periodically to keep dust down. Although Tucson's sanitary landfill is near a residential area and only a half mile from the site of a planned million dollar motel, it is an excellent tribute to the project's effectiveness that there have never been any complaints. There are no odors, scattering of papers, flies or rodents to create public nuisances.

At present, Thomas Price and the Sanitation Department are experimenting with composting with the U. S. Public Health Service. Tree trimmings are being chipped and the chips spread over the cover on the fill to put humus back into the soil. This will benefit the Park Department which will inherit the land.

SPOKANE VALLEY THRUWAY

JOHN CHAFFEE

District Traffic Engineer
Washington Department of Highways
In the *Washington Highway News*

A five-mile section of the Spokane Valley Freeway between Spokane and Opportunity opened in late October. This freeway incorporates the use of curbing at all "on" and "off" ramp locations. The cement concrete gutters and mountable cement concrete curbs help define the speed change lanes and ramp alinement. These curbs give the freeway a "finished" look and make for better traffic operation and fewer maintenance problems.

Five interchange locations will be illuminated with mercury vapor illumination. In addition, fluorescent luminaires are being installed under the Sprague Avenue Freeway Bridges. The Sprague Avenue and Broadway Avenue interchanges have the new constant current series type of circuits with a single transformer.

A feature of the freeway will be the use of 6-inch white lane lines, the same as are used on several eastern turnpikes.

Perhaps the most notable traffic control improvement on the freeway will be the use of large "billboard" type signs made of 1/8-inch aluminum. The typical 6′ x 12′ sign incorporates 10-inch white enameled A.G.A. Stimsonite letters and border mounted on green painted aluminum signboards. The stimsonite crystal reflectors in the letters and borders are similar to those used in car taillights. Most of the 35 of these special signs being used on the freeway will be shoulder and median strip mounted. A few of these signs incorporate 12-inch, 15-inch and 18-inch letters and are mounted on freeway structures; one is on the new "Monotube" type sign bridge. These signs have both good daytime and nighttime legibility and are intended to last from 12 to 15 years. There will also be about 200 Scotchlite metal signs for other signing needs.

• • •

Financing Airport Authorities

The Denver Post is reported to have made a survey of 30 airport authorities, but found that none is able to finance the airports from airport revenue alone. Some are helped by state appropriations or municipal levies.

Sewerage Financing in Ohio

LOUIS J. REIMER

Municipal Finance Consultant
Maumee, Ohio
From Ohio Municipalities

THERE ARE four types of bonds which may be issued for the construction of sewerage facilities in Ohio.

1. *Unlimited Tax General Obligations.* This type of bond must be voted by the people and enjoys the most economical borrowing costs. Care should be exercised so the entire bonding power (5 percent of the assessed valuation) is not engulfed in one project which would place other essential projects out of reach.

2. *Limited Tax General Obligations.* This type of bond does not require voter approval, however, certain abilities for debt payment must be demonstrated. Such bonds are generally retired from sewer charges after providing for operating costs. These bonds also enjoy a modest borrowing cost, slightly in excess of the unlimited tax bond.

3. *Mortgage Revenue Bonds.* This type of bond does not require voter approval. Such bonds are retired from sewer charges after providing for operating costs. The net utility earnings are generally required to be at least 35 percent in excess of the debt payments. Since there is no tax obligation, the borrowing costs are higher than the other types of bonds, but there is no debt limitation.

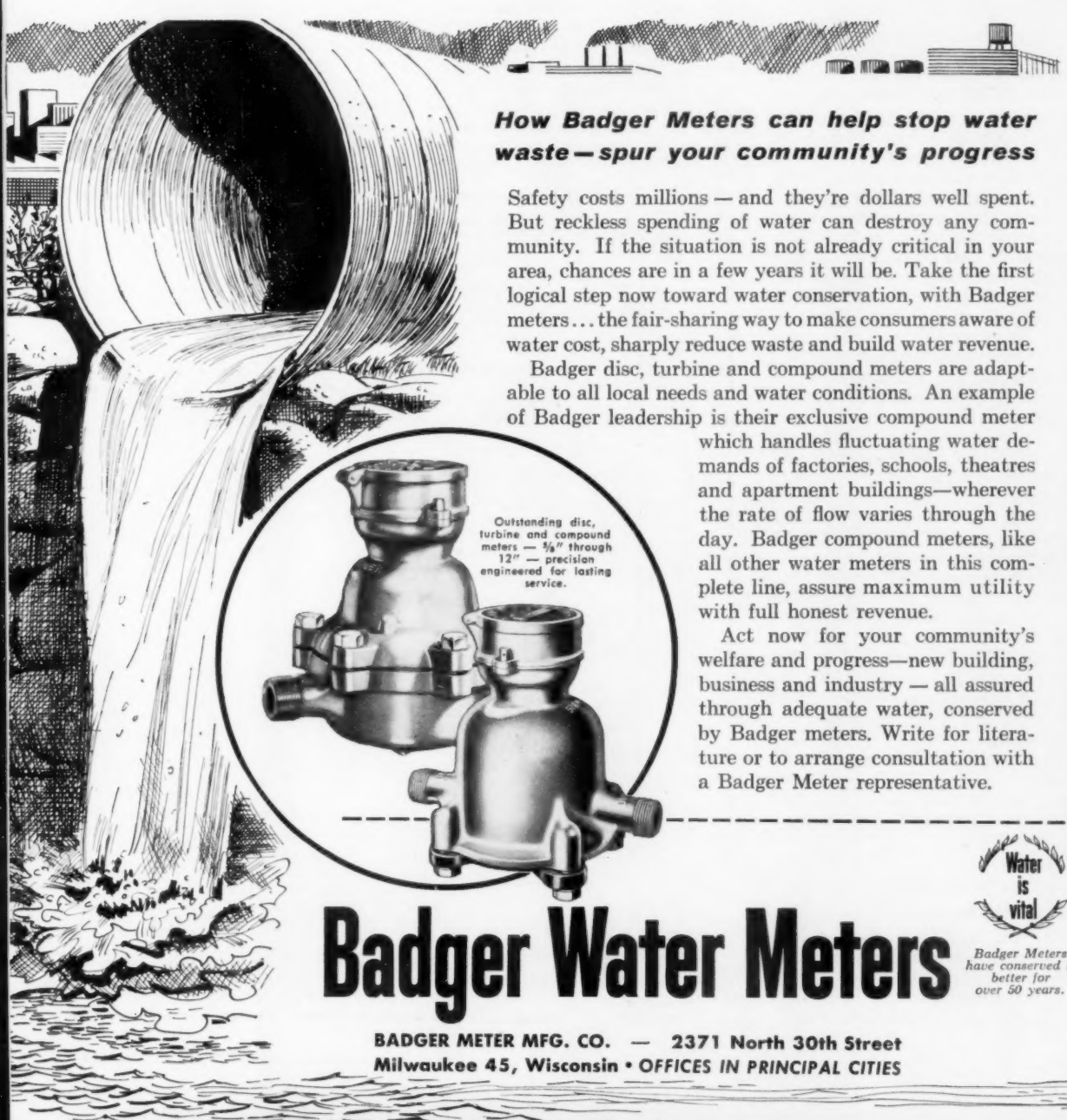
4. *Special Assessment Limited Tax Obligations.* This type of bond does not require voter approval, and is retired from assessments on property. These bonds also have a limited tax obligation if the assessments do not suffice. The bonds may be used to construct a treatment plant but the assessments must be made on benefits derived. These bonds may also be used for that portion of the cost representing local sewers, where an interceptor is laid in unsewered areas and direct taps are allowed. Borrowing costs for this type of bond issue are identical to limited tax obligations.

In cases of high per capita costs for sewerage projects, communities are turning to multiple bond issues. There are many instances where two types of the above described issues were used, and a few cases where three types were used. The more popular two-issue combinations include one of the tax supported bonds along with revenue bonds. When assessments or unlimited tax bonds are used in conjunction with revenue bonds, a considerably lesser sewer charge is possible. It is argued by many authorities that the sewer charge debt redemption bond is the most equitable issue since such charges are in direct proportion to the use of the system.

The use of assessment bonds to finance a treatment plant is quite new, and appears to be a practical answer for many communities which are faced with large capital outlays. A sewer district of the entire city is established and parcels of land are assessed according to benefits. This results in a smaller sewer charge, but does require assessment payments. Considerable savings in borrowing costs can be realized in this type of financing.

Men and property guarded

but how about our most precious possession . . . water?



How Badger Meters can help stop water waste—spur your community's progress

Safety costs millions — and they're dollars well spent. But reckless spending of water can destroy any community. If the situation is not already critical in your area, chances are in a few years it will be. Take the first logical step now toward water conservation, with Badger meters . . . the fair-sharing way to make consumers aware of water cost, sharply reduce waste and build water revenue.

Badger disc, turbine and compound meters are adaptable to all local needs and water conditions. An example of Badger leadership is their exclusive compound meter which handles fluctuating water demands of factories, schools, theatres and apartment buildings—wherever the rate of flow varies through the day. Badger compound meters, like all other water meters in this complete line, assure maximum utility with full honest revenue.

Act now for your community's welfare and progress—new building, business and industry — all assured through adequate water, conserved by Badger meters. Write for literature or to arrange consultation with a Badger Meter representative.

Outstanding disc, turbine and compound meters — ⅝" through 12" — precision engineered for lasting service.

Water is vital

Badger Meters have conserved it better for over 50 years.

Badger Water Meters

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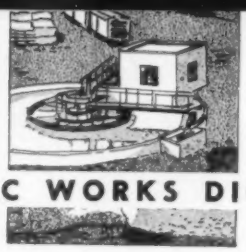


PUBLIC WORKS DIGESTS

THE INDUSTRIAL WASTE DIGEST

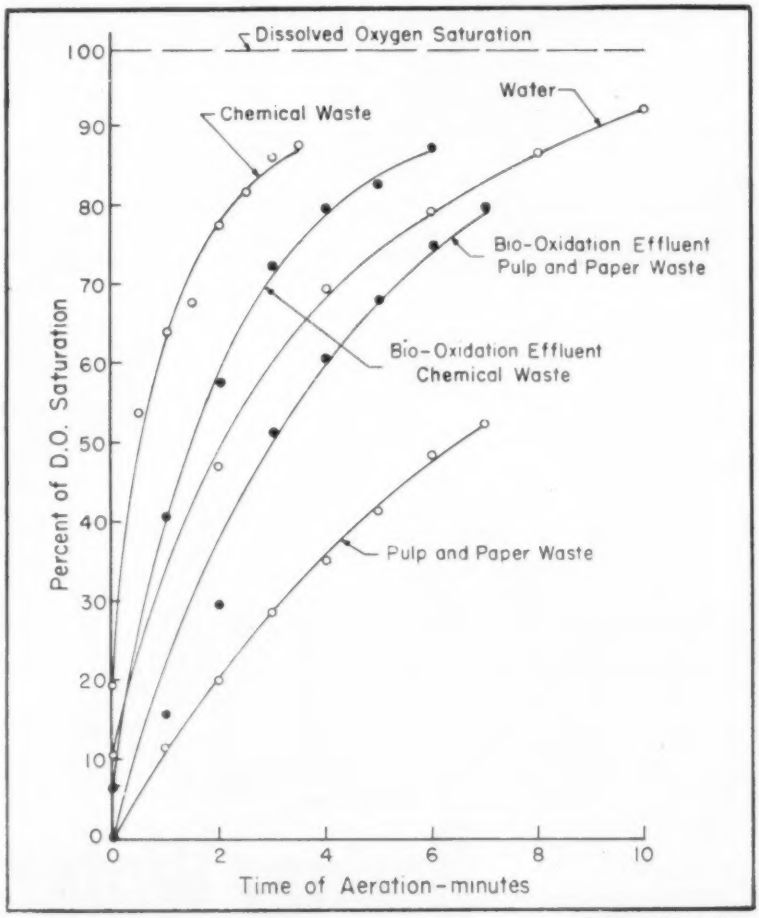
Biological Waste Treatment by Aeration

The factors which must be evaluated for design of aeration systems for waste treatment are the saturation characteristics of oxygen in the waste; the gas-liquid transfer properties of the waste to be aerated; the oxygen utilization characteristics of the liquid-sludge mass; oxygen absorption properties of aeration equipment; and the power requirements of the process. Oxygen saturation in sewage is about 95 percent that of water; various industrial wastes show variations of 50-95 percent of water saturation. Certain constituents in a waste may reduce the transfer rate to as low as 10-20 percent of that of water. Oxygen transfer data may be obtained by diffusing metered air into a waste initially deaerated with nitrogen, with the dissolved oxygen content measured at selected time intervals. In order to take advantage of the decreasing oxygen utilization rate in rectangular tanks, tapered aeration may be employed. The performance of air diffusion devices depends upon the characteristics of air bubbles produced and turbulence generated. When the concentration of dissolved oxygen in solution exceeds 0.2-0.5 ppm, the rate of microbial respiration is independent of oxygen concentration; below that respiration is retarded. In addition to maintaining oxygen levels, power must be supplied for mixing. While the transfer rate will increase with increased power application, there is a limit to be avoided to prevent floc destruction.

"Aeration Systems for Biological Waste Treatment." By W. W. Eckenfelder, Jr., Weston, Eckenfelder and Associates. *Industrial Wastes*, January-February.

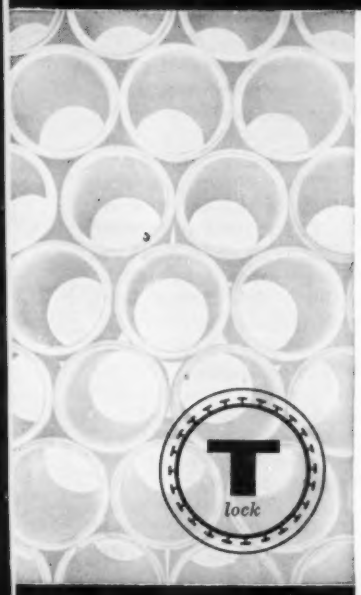
Need for Toxicity Data on Wastes

For the vast majority of compounds contained in industrial waste effluents, there is need for data on the long term effects on humans of drinking water containing minute quantities of the compounds. In spite of the absence of data, no major catastrophes have occurred, probably attributable to the fact that most industrial waste compounds are oxidizable organic materials usable by organisms present in streams. Chronic toxicity data, based on animal feeding while not too often available in the literature, are obtainable, often from the companies marketing a product. The effects on aquatic life are important because malpractice in industrial waste discharge often produces tangible evidence in the form of dead fish, and laws are in existence in many states prohibiting damage to aquatic life. Many references are available on this subject, but if specific information cannot be found by a manufacturer, it should be obtained before stream discharge is considered. In determining the suitability of discharging a waste containing acrylonitrile, hydrocyanic acid and other components to Galveston Bay, the Monsanto Chemical Co. engaged in toxicological studies with respect to aquatic life. The effluent objective was set at one-tenth of the 24-hr. median

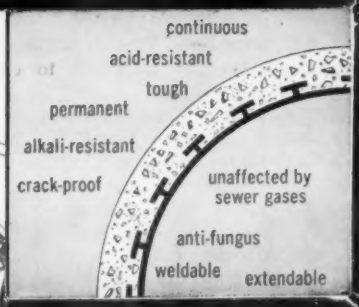


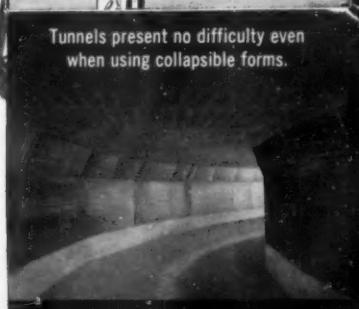
Courtesy Industrial Wastes

● **VARIATIONS in several industrial wastes as regards oxygen transfer capacity.**



T-*lock*® *sewer lining prevents hydrogen sulfide attack...*





Tunnels present no difficulty even when using collapsible forms.

100A

MILLIONS OF SQUARE FEET NOW IN USE! T-Lock Amer-Plate permanently ends corrosion in concrete sewer systems—because it is impervious to hydrogen sulfide, other sewer gases, fungus, bacteria, acids, alkalies and salts.

T-Lock is an extremely dense, flexible, crack-proof liner of high polymer vinyl resin. Integral T-shaped ribs are permanently locked into concrete during pouring. Joints are heat-fused to form a continuous protective lining that will not separate from the concrete even under extreme back pressure.

Over 3 million square feet of T-Lock Amer-Plate have been installed in pre-cast, cast-in-place and monolithic sewer structures of all sizes with no sacrifice of structural strength — at costs comparable to earlier lining methods.

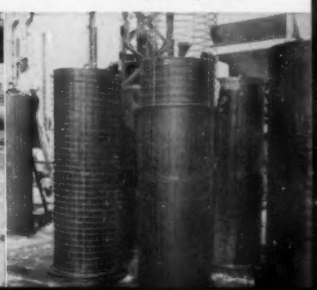
Illustrated brochure and list of typical installations on request.

Houston, Tex.
Jacksonville, Fla.
Kenilworth, N.J.
Evanston, Ill

Amercoat® CORPORATION, Dept.
4809 Firestone Blvd., South Gate, Calif.

Readily adaptable to complex forms for cast-in-place structures.

T-Lock in place on inner form before pipe is poured.



tolerance limit. Similar studies were made on the tolerance to chlorinated solvents.

"Toxicity Considerations in Pollution Control." By J. T. Garrett, Monsanto Chemical Co., St. Louis. *Industrial Wastes*, January-February.

Monitoring for Power Reactor

As part of a planned safety program in constructing the prototype of the Army Package Power Reactor at Fort Belvoir, Va., determination is being made of the radioactive background in the vicinity of the site. Power reactors will be normally equipped with detection instruments, which makes the basic problem measurement of small increases in background that might occur after the plant has become operational. No site is completely free from radioactive background, and little information is available on natural backgrounds prior to 1945. Previous to that date, however, the background at any given site may be assumed to have been constant. To be effective, a monitoring program must be able to detect and measure small increases and recognize and reject those resulting from bomb debris fallout and remote causes. A year of background measurement made prior to initiating operation of a reactor seems to be the optimum period. At Fort Belvoir, samples will be collected of ground water, precipitation, air, river sediment, surface water and dust. When a general purpose laboratory is available, the total capital outlay for a modest program of environmental monitoring is less than $2,000.

"Environmental Radiological Monitoring." By H. N. Lowe, Jr. and D. C. Linsten, Army Corps of Engineers, Fort Belvoir, Va. *Jour., A.W.W. Ass'n.*, February.

Environmental Conditions Affect Bio-Assay Tests

Bio-assay techniques enable estimation, with reasonable accuracy, of the biologically safe concentration for a given compound or mixture of compounds under specific environmental conditions. Variations in environmental factors cause variations in toxicity; an example of this is the relatively greater toxicity of many substances in hard water than soft. Changes in temperature may or may not affect toxicity. Variations in pH resulting from changes in ionic equilibrium may produce variations in toxicity. Increasing toxicity may occur during periods of low dissolved oxygen. The factors of synergism and antagonism are very important in connection with waste disposal. There is little use in achieving a biologically safe waste if certain of its components act synergistically with the waste of a nearby plant. The variability in any natural population must be kept in mind; toxicity varies with age, size, diet and health of fish. A complete bioassay, must include the effect on fish food—plant and invertebrate populations. The time aspect should be taken into consideration—at least two time intervals are necessary for estimating the biologically safe concentration. Designing a plant for average conditions is a mistake; the most unfavorable conditions with regard to both environment and effluent should constitute the basic conditions for bioassay tests.

"Environment and Time in Fish Toxicity." By John Cairns, Jr., Academy of Natural Sciences of Philadelphia. *Industrial Wastes*, January-February.

Acclimatization of Organisms For Petrochemical Wastes

The ability of acclimated microorganisms to stabilize compounds

present in organic and petrochemical wastes was studied on an individual compound basis. The twenty-three chemicals studied included primary, secondary and tertiary alcohols, aldehydes, methylal, and glycols. The method consisted of continuously aerating settled domestic sewage containing a specific compound until floc formation occurred, after which the mixture was fed daily with nutrients and slowly increasing amounts of the compound. Primary and secondary alcohols and aldehydes were readily oxidized biologically, with a major portion of the BOD and COD removed in 4 hours of aeration. More resistance was encountered with tertiary alcohols, methylal, and glycols. Different rates of oxidation were obtained for a given compound by using different acclimated sludges. Because of the toxicity of the organic compounds to the seed micro-organisms in BOD incubations, COD in many instances is important in following oxidation rates.

"Biological Oxidation of Some Organic Compounds." By Richard Hatfield, Southwest Research Institute, San Antonio. *Industrial and Engineering Chemistry*, February.

Other Articles

"Union Oil Company Builds New Waste Water Facilities." By G. W. Brown and James E. Sublett. *Industrial Wastes*, January-February.

"Some Answers to the Meteorological Aspects of Air Pollution." By K. H. Jehn, U. of Texas. *Industrial Wastes*, January-February.

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Fencing for Swimming Pools

In anticipation of an ordinance controlling private swimming pools Norfolk, Va., surveyed other cities' ordinances regulating private swimming pools particularly in regard to fencing requirements, according to *Public Management*. Of the 27 cities and three counties surveyed in regard to fencing requirements seven cities or counties had such regulations; 20 had no such regulations; and three cities did not reply. The ordinances generally require fences to be of a minimum height, safety latches to be installed in the fences, existing pools to comply with the regulations, and a permit to be secured before construction is started. Norfolk indicates that those officials contacted having no regulations in regard to fencing of swimming pools felt it is a growing problem and the cities would have to take action in the near future.

SEWAGE LAGOONS FOR THE TREATMENT of RAW MUNICIPAL WASTES

This article is limited to the proposed use of lagoons as the only treatment of municipal wastes. It is limited also to conditions and costs in the State of Minnesota, where conditions are different than those existing elsewhere. There would appear to be two fundamental concepts in conflict. First, should raw sewage be confined in a container until all threat to the public health is eliminated? Or second, is it permissible to expose raw domestic sewage to possible contacts with insect, bird or rodent life in an open sewage pond?

RANDOLPH L. SMITH
and
HUGH C. LEIBEE,
Consulting Engineers,
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IT IS OBVIOUS that raw sewage can contain most of the microbial life that causes many diseases to man. It is also obvious that our rapid forms of transportation and the return of travelers from all over the world have increased the potential types of infections. For the reason that the technical difficulties of isolating disease bacteria and viruses in a lagoon are extreme, expert opinion as to the probabilities of danger to the public health must be the basis of any conclusion.

The specific question as the public health hazard from the use of raw sewage lagoons was asked a group of bacteriologists at one university and the following was the general opinion: "I talked to some of my colleagues about the survival of viruses in the lagoons, and it is their contention that viruses are likely to survive for long periods of time in such lagoons unless the water is very clear and consequently transparent to radiations from the sun. Most of the lagoons are likely to be turbid, and under those conditions, the viruses can survive for long periods of time."

The specific question was asked the Head of the Department of Bacteriology at one university and the following is his answer: "As a bacteriologist, I believe this practice is unsafe because no provisions are taken to destroy the disease-producing bacteria or protozoa that are likely to be introduced into such lagoons with raw domestic sewage. From common bacteriological knowledge, it is evident that such organisms can survive in lagoons for long periods of time. In fact, they are likely to survive longer in winter months than in summer months. I should think there would be considerable danger of transmitting disease-producing bacteria from these lagoons to human beings by flies and other insects and by sprays or aerosols. Certainly the evidence we now have indicates that viruses will be rather resistant or rather long-lived in such environments."

A Minneapolis pathologist, replied in answer to the question: "There is no doubt in my mind that the lagoon would constitute a real public health hazard to people in the surrounding area. In my opinion, vermin, insects and birds could spread human pathogens over a wide area from such a source."

To the same question, an Associate Professor of Microbiology and Public Health at another state university answered: "I feel that lagooning raw domestic sewage constitutes a health hazard and violates one of the concepts of modern waste treatment. This practice provides an opportunity for the transmission of infectious agents in the sewage to man by insects or other animal life. The problems of insect transmission are minimized during the winter months, but, on the other hand, the lower sewage temperatures tend to preserve the bacteria, and viruses only re-accent the problem with the coming of warm weather."

An Associate Professor of Food Microbiology replied to the same question: "It is my opinion that the collection of the domestic wastes of a community into a raw sewage pond should be discouraged. Such a practice would constitute a health hazard to the people living in its nearby area. Any financial saving which might occur from the installation of such a primitive form of sewage treatment would be more than nullified if the raw sewage pond were the source of a single serious epidemic."

Comparison of Costs

There is a basic requirement that lagoons be located one-half mile from the municipality and one-quarter mile from any homes. The site for a lagoon must be on reasonably level land and should include a good quality of clay as a part of the excavation to produce a reasonable economy. Minnesota has a density of population which makes the location of a lagoon rather difficult and, in some cases, requires miles of outlet line. There is a tendency to use the best land in that particular locality and also to create a psychological loss to the value of property in the buffer zone surrounding the lagoon.

There have been three lagoons constructed in the State of Minnesota at an aggregate cost of approximately $722,000 for a design population equivalent to 20,600 people, or a cost per capita equivalent to $35.

At the same time, standard sewage treatment plants for the same equivalent population range have cost from $19 to $30 per capita. It is obvious that lagoons can be made very cheaply by using poor construction methods. It has been customary to provide a uniform depth and to make the construction of good clay, puddled in place and to include inlet, outlet and possible pumping structures. The so-called design standards for sewage treatment plants have produced a condition in which the capacity of a standard plant today, for the same waste, is about twice what it was twenty years ago. Then the basic theory of design was that the load extended over 24 hours, and a 24-hour BOD composite was the actual condition and would handle any fluctuations. At least two different calculations are made today to increase the size of the plant above this composite BOD theory. One is that, in case of industrial loads extending over a few hours, this load must be increased proportionally as the relation of the 24 hours to the operational time. Second, in the case of recirculation, all return loads must be figured twice. These two cases are only part of the actual picture but do indicate that the so-called "conservative" approach has increased the cost of sewage treatment plants very materially. So we have a case of one method with very advanced standards being compared with another process that has extremely loose standards. It is obvious that any cost comparison between the two methods should be based upon the same standards.

It is possible that a lagoon can be constructed in poor quality land that is well isolated from homes and there would be no psychological objection, but we have yet to encounter such a condition. And when the name "raw sewage pond" is used in place of "lagoon", the objections from local sportsmen and people proud of their community have been quite extreme. There is also the question of effect on subsoil conditions; odors from decomposed plant life; and the release of sewage odors after the spring thaw.

There is no question but that either of the above methods will stabilize the organic material and eliminate the pollution load from our streams and lakes. But it is our belief that waste treatment is for the purpose primarily of protecting public health, and the evidence would indicate that, on this basis, the lagoon method is not a sound method.

Three Overseas Treatment Plants For Drinking Water

Three important overseas treatment plants, using the most modern processes to produce and supply drinking water, were placed in operation in 1955.

At Addis-Ababa, French industry built a complete system to supply the capital of Ethiopia with drinking water. The plan required the raising of an old dam to assure the necessary supply during all seasons. When the dam was completed, a water treatment plant was built with an initial output of 4,000,000 gallons per day. A steel conduit 16 ins. in diameter and 7.5 miles long was laid to carry the treated water to the town's distribution system.

The treatment plant will clarify the water by means of aluminum sulphate, neutralize it by adding lime, filter and sterilize it by gaseous chlorine. Equipment includes a modern settling tank 50 ft. in diameter and a battery of six rapid sand filters, each 260 sq. ft. in area, cleaned by a backwash of water and compressed air. All the necessary accessories and equipment for reagent feeding, sterilization, measurements, control and automatism are provided.

At Tehran, another plant, started in 1954, was completed and put into operation in October, 1955. The project consists of pumping water from the river Karaj, 19 miles from the city of Tehran. Treatment includes coagulation by ferric chloride and clarification in six special settling tanks 77 ft. in diameter. After clarification the water is filtered through sand filters. At present, there are 40 basins of 520 sq. ft. filtering area each to treat the almost 60,000,000 gallons per day. The filtered water is sterilized by gaseous chlorine before being fed into the city network. A plan to enlarge the plant in the near future will increase the output to about 92,000,000 gallons per day, with 60 filtering basins of 520 sq. ft. area each and 9 special settling tanks.

The plant incorporates late improvements in automatic controls and proportional reagent feeding. The extremely clear water leaving the settling tanks is distributed through the filters in a uniform manner, enabling the filters to operate under the optimum conditions. This in turn allows cleaning of the filters to be made automatically at maximum time intervals. When a filter or series of filters has to be cleaned, the operator has only to push a button which starts the necessary operations: closing certain valves; opening others; starting the wash water pump and the air blower; stopping these machines after the proper length of time; restoring the normal hydraulic circuits; and restarting the filtration process. Dosing of the reagents to obtain a better flocculation of the organic matter in the untreated water and dosing the sterilizing product into the filtered water are both entirely automatic, and proportional to the output of the plant.

At Alep, in Syria, where the water source is the river Euphrates, nearly 50 miles away, difficult problems arose due to the distance involved The over-all project was designed to supply the city with approximately 24,000,000 gallons per day (although the first phase supplies only 8,000,000 gallons per day), and includes a water intake from the Euphrates river with sludge settling equipment, as this water often carries a very heavy load of sand and other impurities in suspension. A pumping station has been built to deliver the settled water to the purification plant 2.5 miles away, on a site above river flood levels.

Here the water is treated by coagulation, filtration and sterilization. It is then lifted by pumps to a high point whence it flows by gravity to the city through a concrete channel of ovoid shape nearly 50 miles long. Because of the length of the channel, the water is again filtered and sterilized by means of ozone before it is fed into the reservoirs supplying the city network.

The present plant comprises two special settling tanks 62 ft. in diameter and a battery of 8 rapid filters of 390 sq. ft. each. They are cleaned by automatic backwashing and scour air blowing, which cuts down the number of operators needed. The filter station in Alep comprises only six filters, identical to the others, but the filtration speed used is much higher.

These data, from the French Economic and Technical Bulletin, No. 5, 1956, were sent us by the Water & Sewerage Utilities Division, Dep't. of Commerce.

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No Break for the Parker

A new type of parking meter equipped with an electric eye is being tested in San Francisco. As soon as a parked car moves out of its parking berth the electric gadget

flips up the red flag. The next car to park gets no free time and must start paying all over again. In a twelve day test of 50 meters equipped with the electric eye, it was reported that revenues increased 37 per cent.

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Synthetic Detergents

(*Continued from page* 131)

completely inhibited alum coagulation at very low concentrations but that the critical concentration could be increased by a substantial increase in the alum dosage. From these observations it appears that in water coagulation the effect of surfactants is probably less important than that of the builder compounds. However, by acting as dispersing, deflocculating and suspending agents, syndets appear to oppose water treatment processes which involve flocculation and sedimentation[13].

Various treatment methods have been employed in overcoming such synthetic detergents problems at water treatment plants. Probably the most commonly used expedient has been to increase the dosages of chemicals already in use. However this has not always proved successful. Culp and Stoltenberg[18] have given an excellent account of difficulties encountered at Osawatomie, Kansas, in 1953, together with the remedial measures employed. Osawatomie has a lime-alum softening plant and normally doses with alum at 34 ppm and lime at 200 ppm. During the worst conditions observed about 70 percent of the coagulated material rose to the water surface and filter runs were reduced from 100 to 40 to 12 and finally to 7 hours. The filtered water was colored, slightly cloudy and had a strong disagreeable fishy taste and a faint odor, and frothing was common. A chlorine dosage of 10-15 ppm eliminated the taste and odor. Activated carbon at a dosage of about 40 ppm removed color, taste and odor.

Numerous coagulants were tried in various combinations and dosages. Finally a combination of 25 ppm alum and 1 ppm activated silica, with 10 ppm chlorine added at the rapid mix and 1 ppm chlorine dioxide added to the filter influent, gave good results. A free chlorine residual was obtained with this dosage. The authors found the raw water supply had an anionic synthetic detergent content of 3.9 ppm, and the tap water at Osawatomie contained 3.6 ppm. They considered the presence of syndets as responsible for the problem, with low water temperature, decomposing organic matter and other factors possibly also involved. This case cites a number of criteria which may alert an operator to synthetic detergent problems: rising floc, foam, shortened filter runs, and tastes and odors. Increased use of detergents together with critically low stream flows in some areas may cause similar problems in the future.

While the effects of synthetic detergents on water and sewage treatment works have been quite apparent, the problems caused generally have not been of an order large enough to interfere seriously with treatment processes[13]. There have been notable exceptions, however[18]. With increased use of syndets expected, this impact may change appreciably. Moreover, should newer detergents contain different surfactants and builder compounds, additional and perhaps more serious problems may arise.

Present limited experience has not revealed any evidence of ill-effects to humans resulting from ingestion of small concentrations of synthetic detergents in water, but more conclusive information is needed particularly on the long range effects of such ingestion[14].

A possible solution to many of the problems discussed may lie in changing the formulation of the synthetic detergent compounds. Much would be accomplished if other syndet combinations were evolved which, while exhibiting the same desirable cleansing characteristics, were more readily removed by conventional sewage treatment processes, particularly biological oxidation.

Further studies might be undertaken to determine whether presently widely used alkyl aryl sulfonate detergents can be made to respond to biological oxidation—whether adaptable biological growths can be developed in sewage treatment processes to oxidize satisfactorily these compounds in reasonable periods of treatment. Bogan and Sawyer[15] believe that the oxidizability of anionic detergents may depend more on the particular molecular structures involved than on the chemical type. More investigations should be made on the effect of syndets on the re-aeration capacity of receiving streams, in view of the evidence that this effect is detrimental.

Additional studies are needed to obtain better methods for measuring the amounts and types of syndets present in water and sewage; to obtain information on the effects of phosphates on other coagulants besides alum; to evaluate more accurately the reduction in oxygen diffusion caused by synthetic detergents; and to determine possible public health aspects of synthetic detergents use and if the effectiveness of chlorine as a disinfectant is altered by syndets.

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Subdivision Regulation

(*Continued from page* 127)

carrying out of a subdivision control program. Where this is the case, the health department has a responsibility to present the facts to all concerned.

It must be remembered that every development of land is setting the pattern for a future community. The housing planned and constructed can be a detriment or a pride; for the homes are expected to remain for the next 100 or more years. The health department can help obtain better housing by encouraging the adoption of building codes and plumbing codes, including regulation of private sewage disposal systems. This would be applicable to all new construction, regardless, whether it is financed by a federally insured loan or a private loan. By cooperating in a preconstruction survey, where public sewers are not available, the health department can determine if a septic tank-leaching system can be expected to function satisfactorily based upon the results of soil percolation tests. In this way, a valuable direct service is rendered; proposed new construction comes to the attention of the health department, and new land subdivisions can be immediately brought under control.

The health department sanitary engineer, in carrying out a subdivision control program, can provide guidance to the developer in showing the value and necessity of central sanitary facilities. For example, a realtor may propose to develop a property with individual wells and septic tanks. By simply asking the developer for a report on the feasibility of extending water mains and sewers from a nearby community, before even considering individual facilities, the health department can persuade the developer to adopt the more desirable solution.

It is frequently the case that adjoining communities maintain poor

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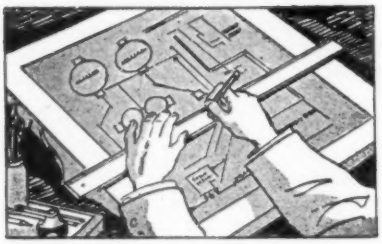

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liaison because of changing politics and personnel. Here is where the health department can use its good offices and show both communities how each can profit from a joint operation.

Subdivision regulation is an essential supplement to proper community-wide planning. It behooves the health department to stimulate and encourage the establishment of planning boards where none exist. County and regional planning is of greater potential value, although town, village and city planning can meet most of the local needs. In this way the provision of water supply and sewerage is integrated into the total pattern of community living. The health department then has a strong partner to help carry a proper share of the burden, and to help take the story to the people.

In the absence of regional or county water and sewerage planning, it is more difficult to require and obtain public water supply and sewerage for new subdivisions. It is therefore proper that the county government be kept advised of the problems associated with suburban and fringe area growth. Possible solutions of the problem can and should be presented. County-wide planning for water and sewerage service, the legislation available, and the steps that can be taken should be outlined. In this connection the health department can furnish a great deal of basic information and justification to support the need for overall planning. An excellent example of the form an overall plan can take is the joint report of the Nashville City and Davidson County Planning Commissions, Tennessee[10].

Cost of Facilities

It is not enough for a health department to say that it is best to have central water supply and sewerage and that, hence, they shall be provided. The development of cost estimates, and the consideration of new treatment devices where necessary, to show that public facilities can be constructed at a reasonable cost will, however, help obtain the common objective. It is not intended that the health department engineer should engage in the practice of consulting engineering. But rather he should, by informed opinion, and by questioning the alleged impossible solutions and their cost, stimulate intelligent answers to the fringe area sanitation problems.

Various water and sewage treatment methods have been used

to serve subdivisions. The number of persons, the treatment required, the first cost, the cost of operation and maintenance, and the type of supervision available are some of the major factors which determine the treatment method. For the small development up to about 50 homes, a plant consisting of a septic tank, dosing tank, open or earth covered sand filters and chlorine contact tank has been found practical. For a housing development of more than 50 homes a plant consisting of an Imhoff tank, standard rate filter with provision for recirculation, secondary settling, chlorination and open sludge drying beds has been preferred. Other methods which have been used are the septic tank-trickling filter plant, the Imhoff tank—high rate trickling filter plant, the activated sludge plant, the aeration type plant, intermittent sand filter plant, primary treatment plant, oxidation ponds, irrigation, and variations or combination of these processes. For 250 homes or more it is usually recommended that the treatment plant include primary settling tanks with sludge collection mechanism and separate sludge digestion.

Quite frequently we are told by developers and builders that sewers and treatment plants are very expensive to build. We may be accused of holding up sound development and of keeping the poor veteran out of a home. The facts are overlooked. More lots are usually possible; the lots and dwellings are more salable; the owner is not put to a future additional and higher expense for sewers; and a more healthful community results. As engineers, we can make preliminary designs, estimate quantities and costs, assemble unit cost figures, make studies and come up with a satisfactory approximation. It should be made clear that such analyses cannot take the place of the consulting engineering services or estimates based on complete engineering plans and specifications. However, they can serve well to indicate approximate costs and aid in the engineering evaluation and validity of proposed projects.

The chart prepared by Velz[11] "How Much Should Sewage Treatment Cost?" is an excellent tool for estimating the bonded project cost of sewage treatment plants to serve 250 or more homes. The accompanying graph gives the approximate construction cost of secondary sewage treatment plants to serve 25 to 1250 homes. This would vary from

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about $350 to $140 per dwelling, respectively. Treatment costs in New Zealand are shown for comparison[12]. These cost figures do not include land, engineering, legal, administration and other incidentals, which may add 15 to 20 percent to the total cost.

Based on unit costs as of, 1955, a sewer to serve an 80-ft. lot would cost about $150, the water main about $185. Public sewers and treatment plant would therefore cost $500 to $290 per dwelling based upon the unit costs given above. These can be used for rough estimating purposes. An average septic tank with a tile field system would cost about $330.

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Some of the material for this paper has been taken from Chapter 8 of a manuscript on environmental sanitation written by the author, and to be published by John Wiley & Sons, Inc., New York.

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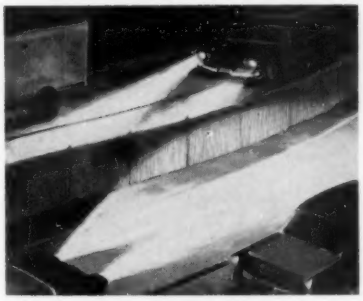
PUBLIC WORKS EQUIPMENT NEWS

Highway Safety Fence of Cedar Logs

A highway safety fence that combines features of safety and beauty has been developed by Habitant Fence, Inc. Designed specifically for use as a center-strip fence for divided highways, the fence installed at heights properly engineered to the slopes and curves of the highway, prevents headlight glare from affecting oncoming drivers. An additional safety factor is the cushioning effect and tough resilience of the full-round cedar logs which resist impact and at the same time give enough cushioning effect to prevent dangerous throw-back into the former lane of travel. The fence is constructed of full-round cedar logs, in varying heights, and assembled on horizontal steel pipe rails with galvanized steel posts set in concrete as vertical supports. Further information and complete specifications from the Highway Division, Habitant Fence, Inc., Bay City, Mich., or circle **No. 4-1** on the reply card.



Glare-Guide Safety Fence is for center-strip installation on divided highways

"Lock-o-Matic" Hub Makes 4-Wheel Drive More Versatile

The Lock-o-Matic, announced by Warn Mfg. Co., can be attached to hubs and locked to obtain "solid" 4-wheel drive, with full engine braking power for ice or hills. "Free" position transforms the 4-wheel drive into a vehicle that handles like a passenger car most of the time, but automatically engages in 4-wheel drive as load or road conditions require. The automatic change takes place in any gear, forward or reverse. The front wheels turn freely, and the front drive train stands still, whenever power is not applied at the front end, with the result that tires and gears last longer, less gas is consumed, and the vehicle has better performance on the highway. Hub models are made for Willys, Dodge, International and Napco 4-wheel drives from ½ to 1½ tons. For further details write Warn Mfg. Co., P. O. Box 6064, Riverton, Station, Seattle 88, Wash., or circle **No. 4-2** on the reply card.

Hub is made for 4-wheel drive vehicles

Protection For Asphalt Surfaces

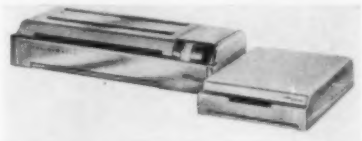
A product designed to protect airport asphalt runways, as well as other asphalt surfaces, from the damaging effects of weather, oil, grease and gasoline is now being produced by Tropical Paint Co. Called Tropical Runway Topping, it lengthens the life of asphalt pavement by retarding oxidation caused by the actinic rays of the sun. It also prevents surface disintegration in cold weather by sealing the surface against the entrance of water. It gives excellent service on asphalt parking areas, service station aprons, roads, driveways, station platforms, playgrounds, tennis courts and other interior and exterior surfaces. Complete information is available from Tropical Paint Co., Cleveland 2, O., or circle **No. 4-3** on the reply card.

Tractor With Dump Body Unit

A new utility dump body tractor has been announced by Worthington Mower Co. The machine is powered by a 162-cu. in. displacement Continental engine that provides power for pulling gang mowers and turf maintenance equipment or hauling heavy loads. The dumpbox of the tractor is constructed of heavy gauge steel and has a capacity of one cubic yard. The pull of a hand lever will dump the load. Complete information may be had by writing to the Worthington Mower Co., Stroudsburg, Pa., or circle **No. 4-4** on the reply card.

Electric Paper Dispenser For Use With Photocopying Machine

An automatic paper dispenser to be used in conjunction with the Apeco Dial-A-Matic Auto-Stat photocopying machine, or with other photocopy equipment, is announced by American Photocopy. Called the Apeco Eject-O-Matic, this new paper dispenser protects photocopy paper from light exposure and automatically ejects one sheet of paper at a time with just a touch of the electric ejector bar. When two different sizes are in constant use, the new machine is engineered so the units can be stacked one on top of the other to hold these two sizes of paper in the minimum amount of space. This all-electric, automatic paper dispenser also features an easy loading principle and simple adjustments to hold 100 sheets of paper. It operates on 110-volt AC and is 16 ins. long, 10½ ins. wide, and 3 ins. high. For more details write The American Photocopy Equipment Co., 1920 W. Peterson Avenue, Chicago 26, Ill., or circle **No. 4-5** on the reply card.



Apeco automatic paper dispenser with the Dial-A-Matic photocopying machine

Equipment Used in Civil Defense Programs and Disaster Emergencies

Automatic Emergency Lighting Unit Provides Protection

Light is an automatic recharging unit

An emergency lighting unit, which not only operates automatically and instantaneously during failures of normal power but also automatically prepares itself for the next blackout, has been developed by the Exide Industrial Div. Immediately following an emergency discharge, the unit automatically recharges its storage battery at a high rate. Requiring addition of water only 2 or 3 times a year, the battery of the new Exide Lightguard is equipped with colored pilot balls which tell at a glance the approximate state of charge. Designed for installation on posts or walls, the Lightguard is available as auxiliary lighting equipment for plug-in connection to 115-volt, 60-cycle alternating current power sources. For further information write to Department AL, Exide Industrial Division, The Electric Storage Battery Co., Box 8109, Philadelphia 1, Pa., or circle **No. 4-6** on the reply card.

Emergency Unit For Civil Defense Programs

A mobile emergency unit, announced by Dana Corp., is used in connection with civil defense programs. The unit, which may be transported where needed by fork truck pickup, or easily pushed on its own rubber-tired wheels to a disaster area by two men, is 7 feet long, 7 feet high, and 4 feet wide. Compartments occupying one side and both ends of the unit hold such vital emergency needs as rubber coats; aluminized asbestos suits and asbestos blankets; helmets; rubber hip boots; two big beam hand lights and other disaster equipment. For further details write Dana Corp., Paris Pressed Steel Div., Reading, Pa., or circle **No. 4-7**

Flasher Safety Lights

Improvements in its line of battery-operated Flasher Safety Lights, designed for dependable hazard warning protection, are announced by R. D. Fageol Co. Known as the HD series, the lights are powered by an 8-cell battery. They produce over 100 brilliant neon flashes per minute and are visible up to 2 miles. Available with either uni-directional or two-way heads, the units can be obtained with a choice of red, amber, blue, green or clear optical plastic lenses in any combination of these colors. For more details write to R. D. Fageol Co., Kent, Ohio, or circle **No. 4-8** on the reply card.

Commercial Markers Using Radioactive Gas

The first commercial high brightness safety signals and markers to utilize the long-lived radioactive gas —Krypton^{85}—have been announced by U. S. Radium Corp. The signals and markers, designed especially for installations where power and maintenance are limited, employ treated phosphor crystals excited to luminescence by Kr^{85}. The devices, readily visible at distances in excess

of 500 yards, are adaptable to a wide range of signal, directional and marking systems. Colors available include blue, green, yellow, pale orange and orange-red. Sources are enclosed in hermetically-sealed, transparent capsules which are weather and tamper-proof. For further information write U. S. Radium Corp., Morristown, N. J., or circle **No. 4-9** on the reply card.

Rescue Vehicle and Ambulatory Unit

This vehicle incorporates all of the features of a squad truck while at the same time providing the shelter and equipment needed for handling ambulatory victims. The basic body, designed and built by Reading

Four-wheel-drive International Model S-120(4x4) civil defense rescue truck meets the Federal Defense Civil authority specifications. Write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 4-10** on the reply card.

Rescue vehicle for Civil Defense Work

Body Works, Inc., fits a conventional chassis and cab. Adapted features include two emergency, all-purpose work tables on which are mounted two collapsible stretchers. There are also cabinets for storing surgical instruments, first aid equipment, portable resuscitators for use in transit, blankets and surgical dressings. In addition, there are shelves for storing helmets, boots and gloves, and storage space for extra folding stretchers. For full information write Reading Body Works, Inc., Reading, Pa., or circle **No. 4-11** on the reply card.

Bituminous Distributor Announced By Seaman-Gunnison

Bituminous distributors embodying a new principle of tank circulation and new "Duo-Flo" spray bar are announced by Seaman-Gunnison. Design of suction and discharge lines creates a constant circulation of material throughout the tank, to protect material quality. The three-way circulation system provides (1) complete tank circulation from end to end for uniform heating of material to required spraying temperature, (2) parallel flow through bar when spraying for uniform pressure at every nozzle, (3) series flow through spray bar when nozzles are closed to maintain tank temperature at bar and nozzles. Full tank circulation continues during bar circulation. In all cases, the material in the tank is positively circulated. Local hot spots are eliminated; there is less evaporation of solvents from overheating; and nozzle-clogging deposits due to coking are prevented. The Duo-Flo spray bar feeds material at tank temperature into both sections of the bar at equal pressure, maintaining material temperature and uniform pressure clear to the ends of the bar. The distributor is available in truck and trailer mounted models in capacities from 800 to 4,000 gallons. Full details from Seaman-Gunnison Corp., Milwaukee 15, Wisc., or circle **No. 4-12** on the reply card.

Agricat Loader With Hydraulic Bucket Tilt

A new, improved Agricat loader equipped with a hydraulically operated bucket tilt mechanism has been developed by Joost Mfg. Co. Designated the Model F long track hydraulic Agricat loader, the new machine may be quickly converted from a loader into an efficient light earthmover by replacing the bucket with a blade attachment. The change-over takes less than 10 minutes. For loading operations, the bucket tilt mechanism permits fully controllable spillage, and may be used for breaking and loosening hard-packed soil after the bucket ripper teeth have penetrated. Converted into an earthmover, the blade attachment also operates from the hydraulic tilt mechanism. The blade (16″ high by 48″ wide) is supplied with a ½-in. by 4-in. cutter bar for heavy duty service, and may also be equipped with side plates. For full information write Joost Mfg. Co., 742 Bancroft Way, Berkeley 10, Calif., or circle **No. 4-13** on the reply card.

Pipe Coupling Machine

Machine is furnished in various sizes

Easier, faster pipe installations are made possible by a new, compact and efficient pipe coupling machine offered by Davis Mfg. Co. The unit is made in various sizes for installing all types of pressure-type joints in cement-asbestos, concrete, clay, or cast iron pipe; 6 inches through 16 inches in diameter. The easy-grip handle pushes to uncouple, pulls to couple, without removing or resetting the unit. For specifications and costs write to Davis Mfg. Co., 10th and Gentry, North Kansas City, Mo., or circle **No. 4-14** on the reply card.

Utility Tractor With Pipe Layer Attachment

A pipe layer attachment for the Massey-Harris-Ferguson Work Bull 202 handles jobs in conection with road building that require top operating economies. This unit, with attachment, lays plastic pipe and electric cable up to 1½ ins. in diameter and to a depth of 18½ ins. Traveling speed while working is up to 3 mph. Added features of the Work Bull are the new dual range 6 forward speed transmission, high speed reverse, in-line shifting, power steering and specially engineered front axle and attachment support for extra-heavy road building demands. A full line of wheel tractors for use on road building assignments as primary equipment, back-up machines and utility or clean-up tools, is manufactured by Massey-Harris-Ferguson. For full details write Massey-Harris-Ferguson, Inc., Racine, Wisc., or circle **No. 4-15**

Distributor is offered in truck and trailer mounted models

Utility tractor is used on many types of construction jobs

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Pottstown, Pa. (Pop. 29,000)—Training and/or experience required. Salary open. Submit resume to:

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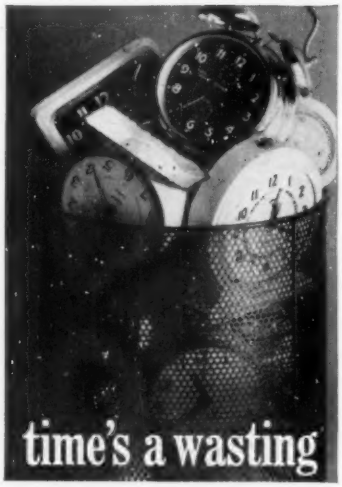

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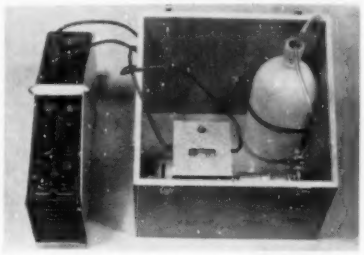
Send your check to "Cancer" c/o your local Post Office.

AMERICAN CANCER SOCIETY

D. C. Effluent Sampler

An effluent sampler, by Phipps & Bird, operates from any 12 volt storage battery. The case, pump, receiver and mode of operation are the same as in the Phipps & Bird

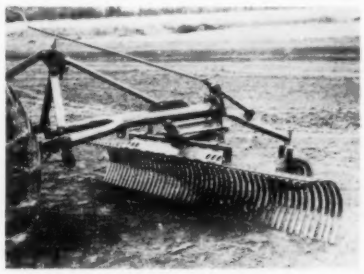


New battery operated effluent sampler

A.C. model. The motor is a modified automobile generator. The timer (D.C. operated) starts the pump every 15 minutes. The pump running time, for each sample, is set at approximately 15 seconds, but may be changed by the user if desired. The quantity of effluent in each sample may be adjusted at will by the user. For full information write Phipps & Bird, Inc., 6th & Byrd Sts., Richmond, Va., or circle **No. 4-16** on the reply card.

Rake Attachment For Arps Utility Blades

A new rake attachment for Arps utility blades has recently been announced by the Arps Corp. Strongly built with closely spaced spring steel tines, the 8-ft. rake is attached easily in only two or three minutes by removing two nuts and one pin and sliding the tool into place. The rake may be angled either to the right or to the left, or in any one of eight positions. In an angled position, the rake will discharge materials in a windrow; in the normal position it can be used for grading, leveling and mulching soil. The ultra-fine screen of the rake makes it valuable for spreading topsoil and preparing seedbeds. Its many adaptations make it a highly efficient and low cost tool for landscapers, builders, highway contractors and highway maintenance departments. For more details write Arps Corp., New Holstein, Wisc., or circle **No. 4-17.**



Self-Propelled Rubber-Tired Rollers

Two new models of self-propelled rubber-tired rollers: 9-wheel 10-ton and 11-wheel 12-ton, are announced by Shovel Supply. These rollers embody many new features, such as quickly removable disc wheels, hydraulic steering and rigid one-piece steel body. The 11-wheel is equipped with torque converter and straight line reverse without having to throw out the clutch. Both models are equipped with water sprinkling tanks and mats when desired. For full details write Shovel Supply Co., Dallas, Tex., or circle **No. 4-18** on the reply card.

Trencher For Laying Water and Sewer Pipe

Depth indicator is exclusive feature

A new ladder type trencher has been announced by Challenge Mfg. Co. It digs square or round bottom trenches of any size between 12 and 18 ins. wide and to 5 ft. 3 ins. deep, either in a perfectly straight line or on any desired radius. Nine travel speeds and eighteen trenching speeds offer a wide range of operating flexibility. The unit will operate over soft terrain, cross open trenches and go where many other trenchers would bog down. A hydraulically controlled 5 ft. 8-in. backfill blade is standard equipment and permits the operator to clear a path ahead of the trencher, level off high spots and refill trenches. For full details write Challenge Mfg. Co., Los Angeles, Calif., or circle **No. 4-19** on the reply card.

Traffic Cone Safety Flashing Device

A new traffic cone safety flashing device, designed to extend marker visibility to night time detection, is announced by Belltron Mfg. Co. This flashing device measures 13 ins. from top to bottom. The light diameter, which is 2¾ ins., permits the unit to fit into the open top of a cone snugly. The light extends 2 ins. beyond the top of the cone and is plainly visible in darkness at 400 feet. A flashing element is incorporated within the bulb and this flicks on and off at 2-second intervals. Operating current is provided by 4 standard flashlight batteries. A choice of red, amber, white or green lens may be specified. Full information from Belltron Mfg. Co., 630 Hoover Avenue, Bloomfield, N.J., or circle **No. 4-20** on the reply card.

Foxboro Introduces New Pressure Transmitter

A new indicating pressure transmitter, accurate to ½ percent of scale range, has been announced by Foxboro, for pneumatic transmission of process pressure measurements. Known as the Model 44 Pressure Transmitter, it measures pressure of 0-30 inches of water to 0-6,000 psi, transmitting a 3-15 psi air signal to indicating, recording or controlling instruments. To accommodate the various ranges, a choice of standard Foxboro pressure elements is offered—spirals, helicals, bellows and diaphragms; element materials are available for corrosive process fluids. Eliminating the need for a separate field gauge, the transmitter has an eccentric indicating scale, 4⅛ inches long, built into the front of the case. Universal mounting bracket provides choice of installation method: wall surface mounting or on vertical pipe. Complete information from The Foxboro Co., Foxboro, Mass., or circle **No. 4-21** on the reply card.

Transmitter weighs only eight pounds

Side Dumping Attachment For Traxcavators

A new side dumping bucket attachment for Traxcavators has been announced by Caterpillar. The prime advantages of the side dumping bucket are to perform in-line loading, eliminating the need for constant turning in order to dig and load, as well as increasing production by reducing loading time. Side-dumping of the bucket is accomplished by the use of a hydraulic cylinder, mounted on the bucket carriage. The bucket is hinged to the carriage, and is firmly locked in place when in the conventional digging position. When side dumping is desired, the operator uses a control lever. When actuated, the dumping cylinder unlocks the bucket from the bucket carriage, and swings it into a side dumping angle of 60°, sufficiently steep to allow even sticky material to be dumped easily. Mounted on a ripper-equipped Traxcavator, the 1½-yd. unit is well suited to such jobs as excavation, road improvement and maintenance, and ice and snow removal. For further details write Caterpillar Tractor Co., Peoria, Ill., or circle **No. 4-22** on the reply card.

Bucket eliminates unnecessary turning

Crawler Tractor For Public Works Departments

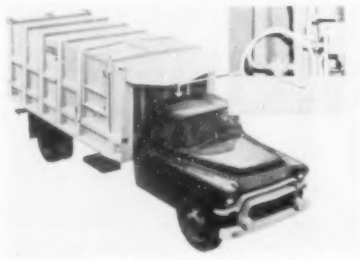
A crawler tractor with a 35-to-1 gear ratio delivering 14.2 draw-bar hp has been announced by Stephen Products. Weighing approximately 2000 lbs., and carrying either a diesel or gasoline engine, the SPI-66G is expected to fill the gap between smaller rubber-tired tractors and heavy crawlers. The unit is 40½ ins. wide, 40 ins. high and 88 ins. long. It is easily transported in small trailer or in pickup trucks. Attachments include: High lift loader, rotary tiller, scoop, 5-tooth scarifier, and spring tooth harrow. For further details write Stephen Products, Inc., Crystal Lake, Ill., or circle **No. 4-23** on the reply card.

Wild Offers New T-16 Optical Transit

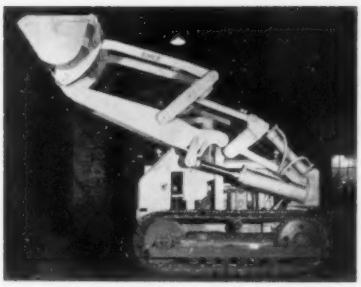
Many new design concepts are embodied in the Wild T-16 Optical Transit, now available from Wild Heerbrugg. The instrument is designed for ease and speed of operation. Circles are read at a glance to 1 minute directly, and to 20 seconds by interpolation. A built-in repeating clamp is used for setting on zero and eliminates lower plate motions. A new optical plummet giving an upright image has also been incorporated in the T-16. For further information write Wild Heerbrugg Instruments, Inc., Main at Covert Sts., Port Washington, New York, or circle **No. 4-24** on the reply card.

Refuse Collection Bodies

Use of a new automatic by-pass valve in the hydraulic compaction system of Hydro E-Z Pack refuse collection bodies is announced by Hydro E-Z Pack Co. The new valve provides a dual return for discharge oil from the packing cylinder during platen return. Hydraulically operated by the packer control valve, the by-pass allows the cylinder to vent both through the control valve-to-tank line and a second line; normally used to supply oil to the pump during the packing stroke. Extremely rapid packing cycles are possible, since the platen need be moved back only far enough to clear the loading area, a distance of no more than 3 to 4 ft. Then, as the body fills and the load builds up toward the front, shorter and faster packing cycles of 82,500 lbs. pressure are used to assure maximum load density. Refuse collection bodies are offered in 14 and 16 ft. lengths, with 16¾ and 20 cu. yd. capacities respectively. For further information, write to Hydro E-Z Pack Co., Galion, Ohio, or circle **No. 4-25** on the reply card.



Inset shows the return by-pass valve



Operator is seated up front on loader

Heavy Duty Loader For Construction and Maintenance Work

A new front-end loader for heavy duty construction and maintenance work has been announced by Eimco Corp. Incorporating a number of engineering advances, the 2½-yard bucket capacity Eimco 105 will dig off high banks and will handle fine, dusty materials. It has a high pivot point on the bucket in full extended position so that although the dumping height is 11 ft. 6 ins., it can reach over a 14-ft. high bin or hopper to discharge its load. Its torque-converter and 143-hp diesel engine provide sufficient power to permit simultaneous operation of crawler tracks, boom and bucket. The machine is particularly applicable where strong downward pressure is necessary and its independently operated tracks give it maximum maneuverability, even to spin-turning in its own length. For full details write The Eimco Corp., 634 South Fourth West Street, Salt Lake City 10, Utah, or circle **No. 4-26** on the reply card.

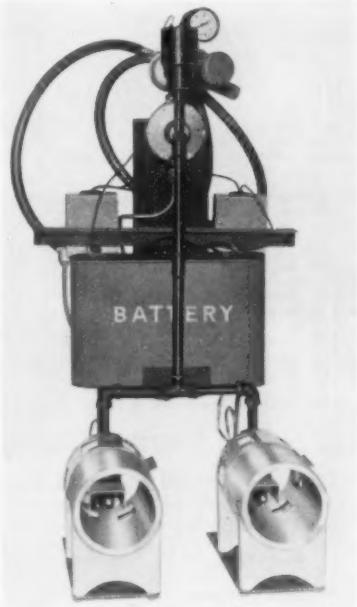
Power Sweeper For Inside Maintenance

A power sweeper introduced by Wilshire Power Sweeper is driven by a Wisconsin air-cooled 15-hp engine. A multiple disc reversing clutch, 3-speed transmission and drive axle mounted differential, and a heavy chain drive from transmission to differential make up the power train. A new dust system incorporates the use of a high volume fan which deposits all the dust into a bag that can be cleaned without removal from the machine. Dual switches mounted to the steering column actuate both the hydraulic dump on the hopper and the 7-in. lift of sweeping chamber enabling the machine to sweep bulky debris. Write for full information to Wilshire Power Sweeper Co., Dundee Ave., Elgin, Illinois, or circle **No. 4-27** on the reply card.

Sweeper is powered by a 15-hp engine

Asphalt Kettle Burner

The perfection of a new asphalt and tar kettle burner, that not only simplifies, but speeds up the heating of tar, asphalt and pitch, is announced by Flamegas Detroit Corp. It is a compact, self-contained, portable unit, available with either single or double burners. Multiple units can be mounted, if desired, as on multiple flue wagons. Attachments are available for spray bar heating, pump pre-heating, spot repair pre-heating and drying etc. The units can be mounted in tank trunks, portable tanks, or kettles quickly and easily. The burners are readily adjustable to any height or width. These new burner units operate on propane (LP) gas. For more details write the Flamegas Detroit Corp., 12901 Auburn Avenue, Detroit 23, Mich., or circle **No. 4-28** on the reply card.



Burner is used in asphalt construction

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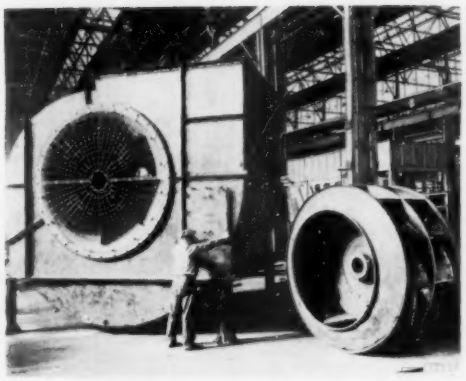
—Worth Seeing

Interesting displays scheduled for the Florida Engineering Society Convention in Orlando, April 25-27, include this exhibit of Tylox couplings pre-assembled in bells of Universal vitrified clay pipe.

Executives of Daybrook Hydraulic Division, L. A. Young Spring and Wire Corp., Bowling Green, Ohio, met in New York to announce new complete lines of Daybrook truck equipment. L. to r: A. S. Novie, Eastern Zone Mgr.; R. E. McCreary, Sales Prom. Mgr.; J. F. McKiernan, Sales Mgr.; E. Y. Roberts, Chief Eng.; T. W. Helwig, Gen. Mgr.



24 of these king-sized fans by American Blower Division of American-Standard, when operating full speed, supply more than 3 million cu. ft. of air per minute to the great new Baltimore Harbor Tunnel. 8 more fans are on standby. Total contract for nearly $1 million was awarded on basis of initial cost and operating expense.

County-owned International Drott TD-9 Skid-Shovel depositing load of gravel in one of 9 trucks on a Quitman County, Miss., road job. When not loading gravel the Skid-Shovel is used to rebuild old bridges and culverts.

On the New York Thruway these blue signs with white lettering, mounted over the road on one piece Union Metal tapered Monotube poles and beam segments, help the speeding motorist pick the correct lane in ample time.

by Arthur K. Akers

★ WITH pleasure we chronicle the election of William H. Reeves as president of Layne & Bowler Inc., Memphis, the world's largest water developers. He has been vice president for many years. 1957 is the company's 75th anniversary year.

Mr. Reeves

Mr. Humes

★ AGAIN with pleasure, we note the promotion of Robert W. Humes to sales manager of Sherman Products Inc., Royal Oak, Mich.

★ O. B. (Jack) LANCE is now director of advertising and public relations for the Texas Vitrified Pipe Co., Mineral Wells, Texas, including the Southwestern Plastic Pipe Co. subsidiary division.

★ THE "JAY" Company, Columbus, Ohio, appoints T. T. Mosier as general sales manager in charge of all territories, domestic and foreign. Paul O. Stentz is upped to assistant general sales manager.

★ STEPHEN W. BENEDICT becomes executive vice president of the Master Builders Co. division of American-Marietta Co., a newly-created position.

★ LATEST expansion note from Norton Co., Worcester, Mass., tells of groundbreaking for a new $1,500,000 refractories plant to care for sales grown ten-fold.

★ SHAWNEE MFG. CO., Topeka, Kansas, has been purchased by Stearns Mfg. Co., Adrian, Mich., to be operated as a wholly-owned subsidiary but with no changes in the Shawnee management.

★ HYDRA-NUMATIC SALES CO., Hackensack, N.J., is a new company offering sales engineering services and products to the sewerage, water and industrial wastes field in the Northeastern states and New England. John J. Horgan, Louis J. Nemecsek and John W. Stika, for some twenty years with Ralph B. Carter Co., head the new firm.

★ VINCENT J. CALISE is new general sales manager, Graver Water Conditioning Co., New York.

★ HARRY C. HAMILTON is now regional manager for road machinery sales in the midwest for Standard Steel Corp., Los Angeles.

★ NEW OFFICERS of Massey-Harris-Ferguson, Inc., Racine, Wis., include Albert A. Thornbrough, president; J. H. Shiner and H. A. Wallace, vice presidents.

Mr. Thornbrough

Mr. Brent

★ EDWARD STERLING BRENT becomes sales manager, Road Maintenance Equipment Division, Littleford Bros. Inc., Cincinnati, succeeding L. W. Glaser, now sales director, Southern territory.

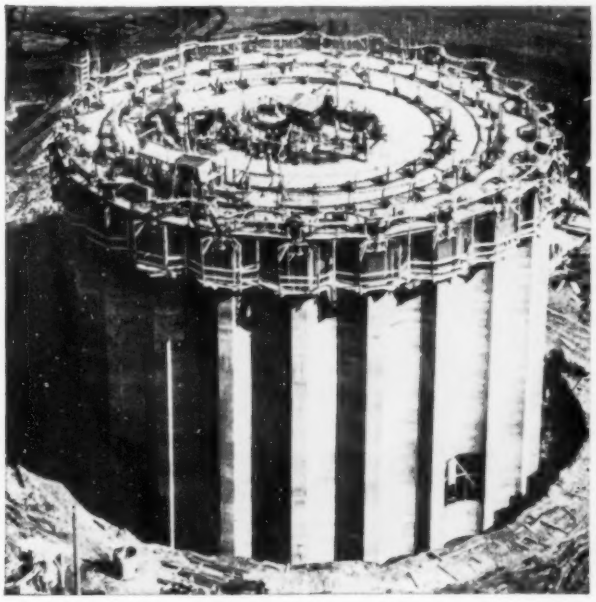
★ FOX BODY CO., Janesville, Wis., rises from the ashes of its twice-burned-out plant to re-enter the national field of building special truck bodies. The fires were taken as an opportunity to rebuild and re-equip in the most modern way.

★ THE CO-ED concluded her prayers with this modest appeal: "I'm not asking for myself, but please send my mother a son-in-law."

—Paterson Evening News

LARGEST TANK OF ITS TYPE...

City of Dallas, Texas 2,000,000-gallon prestressed concrete water tank. Supported on reinforced concrete slab resting on four concentric ring walls. Substructure walls built simultaneously with slip forms using hydraulic jack system. Pozzolith employed in the concrete. Design: The Preload Co., Inc., New York City; Prime Contractor: Whittle Construction Co., Dallas. Sub-contractor for prestressing: Preload Construction Corp.



Left: View of the four tower cylinders under construction, with slip-form platform at top.

Right: Wire-winding machine wraps finished tank in pre-stressing operation.

POZZOLITH employed to obtain top results in Slip-Form Concrete

This giant water tank is one of many slip-form projects in which Pozzolith was used because it provides three controls required for optimum concrete performance in this type of construction. These controls are:

1. Lowest possible unit water content, with controlled placing consistency...for dense, segregation-free concrete.
2. Control of entrained air...for designed strength with required durability.
3. Control of rate of hardening . . . for desired handling and finishing time under widely varying job conditions.

An illustrated bulletin that describes how Pozzolith was an aid in improving the control of concrete quality on slip-form work is available. Copy sent on request.

Whatever the type of construction, Pozzolith will give you superior concrete performance. May we demonstrate?

ENGINEERS and ARCHITECTS employ POZZOLITH with confidence

★ *proved performance* ...138 million cubic yards of concrete produced with Pozzolith for all types of jobs.

★ *applied know-how* . . . more than 100 skilled Master Builder's field men for product-use consultation.

★ *available everywhere*...over 1000 ready-mix and job-site plants now producing concrete with Pozzolith.

The MASTER BUILDERS Co

MASTER BUILDERS PRODUCTS

CLEVELAND 3, OHIO • TORONTO, ONT.

Division of American-Marietta Company

Cable Address, Mastmethod, New York

W&T V-notch Chlorinator at Esso's Baton Rouge Refinery feeds chlorine at rates up to 500 lbs./24 hr. over a 10 to 1 feed range. Other V-notch models are available with maximum capacities from 500 to 2000 lbs./24 hr. over a 20 to 1 feed range.

NEW W&T V-NOTCH CHLORINATORS

are rugged–easy to operate–moderately priced.

The W&T V-notch Chlorinator installed at the Esso Standard Oil Co. Refinery, Baton Rouge, La. is housed in a shed open to the sun, weather, and water spray drifting from a cooling tower. The average water or sewage treatment plant operator would consider this rugged service for any piece of equipment.

W&T V-notch Chlorinators have proven in this and other installations that they can withstand rugged service. The design of new V-notch Chlorinators uses not only modern corrosion proof materials but a new concept of chlorine gas control, the W&T V-notch Variable Orifice. V-notch Chlorinators are easy to operate and maintain. They provide the precise chlorine control that is expected from Wallace and Tiernan equipment. In addition, W&T V-notch Chlorinators are an attractive piece of equipment, colored soft green to fit into plant color schemes.

Ask your local W&T representative for more information about W&T V-notch Chlorinators or send for Bulletin S-113.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY